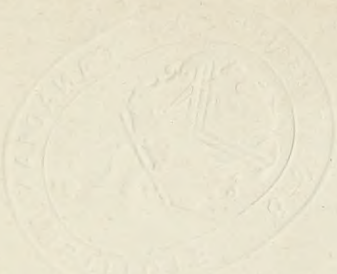

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HISTORICAL REVIEW OF THE FORCES GOVERNING SANITARY ENDEAVOUR.

By BUSHELL ANNINGSON, M.A., M.D.

(Fellow.)

BY "*Sanitary Endeavour*" is meant efforts to safeguard the natural and uniform working of the human organism whether regarded singly or in groups. The early efforts were, as may be fairly assumed, exerted for the benefit of the individual alone; anything more than this pre-supposes community of action which obtains only in more or less organised human settlements. This is the line of reasoning adopted by Sir John Simon in his chapter on the probable origin in prehistoric times of some sort of Sanitary Endeavour. Two results would follow from the formation of such settlements (*a*) the possibility of community of action, which would be beneficial; (*b*) the local pollution of the site by a continued sojourn in the same spot, which would be injurious, and indeed, evidences of such pollution have come down to our time.

These considerations lead naturally to the inquiry as to the conditions of life, especially of civilised life, that are injurious to natural and uniform workings of the human organism during the natural term of its existence, till indeed it fails to act because it is worn out, and not because it has been broken by some preventable cause. These preventable causes may be classed as follows: the fever inducing disease germs; the larger animal and vegetable parasites; poisonous food; mechanical irritants in air, food, and water.

The recognition first of the ability to prevent injurious consequences without any distinct knowledge of cause led to an *art* more or less *fallacious* of preserving health, and the subsequent recognition of the real cause led to a *science* more or less *exact* of preserving health. It is not, however,

till we reach historic times that there arise any well-directed efforts to combat these foes of continuous healthy life, and then they have regard to the health rather of the individual than of the community. The motive forces of these efforts have been of several sorts: The first that may be mentioned is the incentive force of self-preservation which has been already mentioned as the only sanitary force operating in the natural man. Subsequently to the forces of primeval natural instinct of avoiding evil and seeking good there arose among the ancients, the religious force, having either a passive or an active expression. The first was a *nature worship* which deified natural objects, and among these religious fancies none were more beautiful than that reverent regard for running water, which may have saved many a sacred spring from the desecration of filth pollution. The same reverent feeling with regard to natural things exists among North American Indians and is quoted by Longfellow in the story of *Hiawatha.* The active expression was the influence of the medicine men and medical priests represented in Grecian times by Æsculapeus and his lineal descendants; the seventeenth in succession of this priestly race, viz., Hippocrates, was (if we except Phasi the Arabian) the first scientific physician, and had ceased to be a mere priest physician when he wrote treatises on "Air, Water, and Places." His medical successors taught the importance of dietetics and "personal hygiene" till the rise of the sect of the Empirics, of the Alexandrian School, who opposed the teaching of Hippocrates.

Of other forces which may be passed in review, but not necessarily in any natural order of sequence, one is the influence of enlightened rulers of mankind, and the greatest of these, whom though hackneyed in every sanitary address of recent years I cannot forbear to mention, is Moses, whose marvellous code of sanitary methods, including isolation of cases of *infectious* disease, must have been copied from an Egyptian system of sanitary medical knowledge; but probably, unlike his teachers, in order to enforce what he regarded as needful observances on a race inferior in culture to the Egyptians, he associated his scheme with religious conditions in the manner of the Priest-Physician. The inherent soundness of the Mosaic sanitary system has been established by the experience of comparatively recent times, for during the fourteenth, fifteenth, and sixteenth centuries, when infectious disease held triumphant sway in this country and many other parts of Europe (especially among the adherents of Christianity), the Jews, and I may add here the Mahommedans also, enjoyed a remarkable immunity from disease, which can be attributed only to their strict observance of sanitary codes held in common, and not to racial peculiarity.

So marked indeed was this immunity that the Jews were accused of spreading disease among others, while they themselves escaped, by poisoning the wells; and many thousands are stated to have been burnt alive as a punishment for this imaginary crime. To quote the late Dr. Guy: "Recent discoveries have rendered it highly probable that the people were not always mistaken as to the fact of the poisoning, but only as to its nature and the persons who caused it. In those remote times the state of the places in which men lived, and their habits of life, rendered the pollution of drinking-water by human excreta inevitable, and so secured the rapid spread of any water-borne disease that happened to prevail."

Another example of this form of sanitary force is afforded by the municipal laws of Lycurgus, law-giver of Sparta.

Among minor instances of action of independent men in more recent times may be mentioned Viscount Bernabo, who, recognising the infectious character of the plague, made an edict, 17th January, 1374, requiring that "every plague-stricken patient was to be taken out of the city into the fields, there to die or to recover. Those who attended upon the plague-patient were to remain apart for ten days." Viscount John, successor of Bernabo in the year 1399, on an invasion of the plague in Italy, ordered that "no stranger should be admitted from infected places, and that the city gates should be strictly guarded; infected houses were to be ventilated for at least eight or ten days and purified from noxious vapours by fires, and by fumigations with balsamic and aromatic substances. Straw, rags and the like were to be burned; and the bedsteads, which had been used, set out for four days in the rain or the sunshine, so that by means of the one or the other, the morbific vapours might be destroyed. No one was to venture to make use of clothes or beds out of infected dwellings unless they had been washed and dried at the fire or in the sun. People were likewise to avoid as long as possible the occupation of houses which had been frequented by plague-patients." In this quotation of ordinances of the 14th century one almost recognises a clause of the Public Health Act of 1875, and the Infectious Disease (Prevention) Act of 1890.

Another active force was the influence of scientific observers or philosophical thinkers who have tried to impress on mankind reasons for Sanitary Endeavour, or have expounded the causes of ill-health and premature death, but these are too numerous, especially during our own era, for any complete record. One of the great men who guided his fellows in regard to one of the most singular epidemics of this country was Dr. John Caius, who wrote a "Boke of Counseill against the Sweate,"

that is the sweating sickness which prevailed during the middle of the 16th century. Dr. Hodges in his work on the plague, entitled "Preservation from a Pestilence," gives very sound advice as to the separation of the sick from the healthy, and the use of disinfectants, especially nitre and sulphur. Dr. Brocklesby (Army Surgeon), about the year 1770, recommended destructable huts in the treatment of cases of Typhus Fever. The greatest sanitary benefactor of the 18th century was Jenner, who by observation and by inductive reasoning arrived at the discovery of vaccination as a preventive of small-pox. To take two more examples belonging to altogether different types of diseases, Sir George Baker, by the same methods of reasoning, was led to the discovery of the cause of the Devonshire Colic, and Captain Cook in like manner discovered the cause of scurvy among seamen.

Another important sanitary force has been the efforts of distinguished philanthropists who had become strongly impressed by the sufferings of those around them. Such a one was Howard, who by his investigations into the causation of jail fever, convinced the Legislature of the bad sanitary condition of the jails in regard to both construction and administration, and was instrumental in causing the passing of the Sanitary Act, 1774. In addition to his efforts with regard to jail fever, he, in his quality as a country squire, had every cottage on his estate at Cardington that he owned or was able to purchase pulled down and rebuilt them, paying, in this work, special regard in their reconstruction to wholesome cheerfulness and comfort; this was in effect a voluntary anticipation of the Artizans' and Labourers' Dwellings Act of recent times. This man, after fighting with pirates in the Mediterranean and thieves in the Crimea and risking fever and plague in different parts of Europe, at last ended his life's labour by contracting the very fever he had spent himself in fending from others, and died a martyr after living an apostle.

Howard was anticipated in his views as to the cause of jail fever by Sir John Pringle, who, in his account of this disease, attributes its incidence and spread to tainted air.

The last man of which the limitation of space permits mention is that of Sir Edwin Chadwick, only recently deceased, to whom is due in greatest measure the Health of Towns Commission of 1842, which has practically compelled much of the Sanitary Legislation that has followed.

Still another force is found in Governments and State Authorities, as distinguished from Autocratic rulers, and these have, for political or economic reasons, from time to time made efforts for the betterment of the populations that they served or governed, but this action of theirs

has been in a measure controlled by the varying conception of the theory and attributes of the State.

According to Bluntschild, groups of men may be regarded as made up of (1) the Family: (2) the Clan: (3) the Race or Horde: (4) the Tribe. To constitute a nation, he says, there must be a relation to locality and to the soil; Nomadic peoples, such as the Hebrews and Arabs, are not a Nation or State.

In all States there exists the distinction between the governors and governed (Gegenstaats). Where there is no sovereign authority, where the governed have renounced political obedience, there is "Anarchy," which, like all negations, cannot last.

The idea of the State has not been the same among all peoples, therefore sanitary endeavour, so far as there has been any such in the past, as administered by the State, was a reflex of the existing attribute of the State.

Again, according to Bluntschild, in "The Hellenic Idea of the State," "The State was all in all and over-rode the rights of individuals; the citizen was nothing except as a member of the State." The Roman State, on the other hand, left much to social customs and to the religious nature of men. The family was more free as against the State, and private rights were better protected even against the arbitrary exercise of public authority. The Teutonic peoples were not, as were the Romans, an eminently political people; and it was with reluctance the individual submitted to the sovereignty of the whole body. Therefore, had the meaning of sanitary endeavour been known to the Greeks as it is to men of the present day, their political system would have lent itself readily to the establishment of such authorities as are in this country represented by the Local Government Board, the Board of Education, &c.; while under Roman and Teutonic systems municipal authorities would, as now, have had a large direction of local affairs. Rome, both during the Republic and during the Empire, was distinguished for its *municipal* institutions, and its government by councils or corporations, which were invested with special regulative powers, and by special municipal officers, both of which have formed models for subsequent ages. The sanitary endeavour therefore of the Romans was of a municipal rather than of a national or imperial order of sanitary laws and regulations; such information as has come down to us, indicates that this endeavour was directed not so specially against plagues as against those conditions which foster and propagate plagues. Officers called Ædiles and Censors, exercised supervision over cleanliness and paving of streets, the construction of

drains and sewers, for the prevention of foul smells arising from decomposing material of all kinds, prevention of nuisances, of ruinous or dangerous houses, besides sundry police duties. There was besides a scheme for the removal of city refuse both by large sewers and by scavenging. By-laws (if we may so call them) were promulgated for the regulation of such matters as were of common concern—viz., burial outside the town, for prohibition of carting filth in the public streets, for sufficiency of space about dwellings, and last but by no means least, for the protection from injury or befoulment of the public fountains. During the Empire a class of official *medical* persons were appointed, but it is not quite clear whether they performed any of the functions which now appertain to health officers, but such seems probable. Besides these municipal regulations, remains of public works may be seen to this day, such as sewers, public baths, and aqueducts or artificial water-courses for the supply of abundance of clean water. After the fall of the city of Rome and its occupation by hordes of barbarians, this high efficiency was lost for centuries and dirt became sanctified; but wherever any revival of cleanly living occurred the tradition of the Roman model was followed. Of this an example is afforded us at Venice, which had become the greatest maritime town in Europe, and had large commerce with the East so far as it was then known, and thereby was exposed to invasions of scourges, especially the Oriental plague, which came along the trade lines from its endemic home in China. In or about the year 1629 Alexander Tadinus wrote his book on the Great Plague, and it appears from a book on anatomy by Caspar Oselli, of Cremona, that this Tadinus and one, Septalius, a senator, were both superintendents of protection of the public health. "Tuendæ publicæ sanitatis præfecti." During the same period lazarettos or infectious disease hospitals were provided, and a measure of "quarantine" was imposed on all vessels coming from infected countries, or having cases of infection on board. Beyond the establishment of these hospitals there appears no record of public works such as those instituted by the Romans.

The last of the forces to be mentioned is the popular voice, which is an agency of uncertain value, but it has done more good in the present than in the past. It was represented in the past by the empirics of the Alexandrian school, of whom Dr. Corfield says, in an address in 1879 to The Sanitary Institute on Sanitary fallacies, "This school has existed ever since, exists at the present day, and has to answer for a great deal of the distrust that exists in the public mind in connection with the national study of medicine and the national teaching of sanitary science."

It was the popular voice that shouted for the lives of the Jews as the best remedy they could devise against the ravages of infectious disease, not knowing that they themselves were the chief agents in its spread by their filthy habits. The heathens of olden times, especially Romans, could have taught much of kindliness and toleration to the Christians of medieval Europe. Uninstructed or misinstructed popular opinion may by its liability to slide into fanaticism or prejudice do wrong, and defeat an object essentially good and even beneficial to the community. On the other hand, an educated and unprejudiced popular opinion has brought about many measures of great sanitary value. The machinery employed in recent times has generally been "Sanitary Associations," such as was evolved out of a newly interested people by the revelations of the "Health of Towns Commission;" one of these was called the "Health of Towns Association," and laboured during the period of 1845 to 1848, when the "Nuisances Removal" and "Diseases Prevention Act" were passed as a first instalment of that continuous sanitary endeavour which has been not the least of the many glories of the Victorian Era. This Association or others like it took up the grievous sufferings endured by many groups of workers, such as the London bakers and the poor helpless seamstress; these and many another have had their ills righted by the persistent efforts of a healthy and intelligent public opinion.

In conclusion, the word may be quoted of one of the sanitary worthies but just now gone prematurely to his rest: "If we need," he says, "any fresh incentive to our labours, we have but to compare the terrible death-rate of the past with the diminished mortality which has gone hand-in-hand with the scientific application of the principles of sanitary medicine to the circumstances under which we live."

THE TESTING OF DRAINS.

By LOUIS C. PARKES, M.D., D.P.H.,

Medical Officer of Health, Metropolitan Borough of Chelsea.

Read at Sessional Meeting, December 10th, 1902.

THERE appears to be no express statutory sanction for the testing of drains by the officers of sanitary authorities. Section 40 of the Public Health Act, 1875, requires every local authority to provide that all drains within their district be constructed and kept so as not to be a nuisance or injurious to health. This section may in some sense be presumed to indirectly authorise and sanction the testing of drains, as it is difficult to see—drains being underground and out of sight—how the local authority can perform its duty under the section, unless its officers ascertain by some test that the drains in the district are constructed and kept so as not to be a nuisance or injurious to health. Indirectly then, but not expressly, there appears to be statutory sanction for the testing of any drain in a district, even if it is not actually a nuisance or injurious to health, to ascertain if it is constructed and kept so as not to be a nuisance.

In the case of drains which are a nuisance or injurious to health, there is the power to open the ground and examine the drain, which is conferred by Section 41 of the Act of 1875, upon the written application of any person to the local authority, stating that the drain is a nuisance or injurious to health (but not otherwise). Any person, in this case, would undoubtedly include the Sanitary Inspector, who, after reporting to his local authority that the drain is a nuisance, may proceed, after twenty-four hours' written notice to the occupier of the premises, or in case of emergency without notice, to enter the premises, open the ground, and examine the drain. This examination may doubtless be something more than a mere inspection. It would include the application of some reasonable test, in order to ascertain that the drain is in good working order,

and able to perform its function of removing waste matters by water-carriage with efficiency. According to the words of the section (41), in the event of the drain on examination appearing to be in bad condition, or to require alteration or amendment, the local authority shall forthwith serve notice on the owner or occupier for the execution of the necessary works. The application of some test to the drain may be considered as necessary to ascertain if it is in bad condition, or requires alteration and amendment. No doubt the section gives power to the local authority to expose the entire length of the drain for the purpose of its examination. But the words of the section certainly do not exclude the more usual method of exposing a portion only of the drain, with a view to the application of some test from the exposed portion. It is evident also that the section contemplates the doing of some damage in the course of the examination—(it may be by removing a pipe, or breaking into the drain), as, in the event of the drain being found to be in proper condition, any damage done is to be made good at the expense of the local authority.

In the Metropolis, under Sections 40 and 41 of the Public Health (London) Act, 1891, a similar power is given with respect to the examination and testing of drains as in Section 41 of the Act of 1875. It is true that the word drain is not especially mentioned in Sections 40 and 41, but the words actually mentioned, namely: *water-closet*, *trap*, *siphon*, *pipe*, *or other works or apparatus connected therewith*, are no doubt of sufficiently wide meaning to include drains. Moreover, Section 40 gives power to open the ground to ascertain the course of the drain; and it is unreasonable to suppose that the legislature, whilst giving such power to ascertain the mere course of a drain, intended to withhold the power to ascertain if the drain was in bad condition. Under these sections the sanitary authority can make the examination, without any previous notice in writing from "any person" that the drain is a nuisance or injurious to health. The sections appear to indicate that the object of the examination is to ascertain (1) if the drain is in a bad order and condition, or requires cleansing, alteration or amendment; if so, notice is to be served upon the owner or occupier. (2) To ascertain if the drain is in accordance with the Act and the By-laws of the County Council and Sanitary Authority. In the event of the drain being found in good order and condition, but not in accordance with the By-laws, the sanitary authority appears to have no power to insist upon its being made in accordance, but can merely have refunded, by the person offending, the expenses of the examination.

The only definition of what a house drain should be, that is contained

in any statute relating to public health, is to be found in Section 96, sub-section *f*, of the London Act. This relates to underground rooms, and requires that any drain passing under the room is to be properly constructed of gas-tight pipe. This of course can only be ascertained by the application of some test.

In London, under Section 1 of the Public Health (London) Act, 1891, sanitary authorities are required to put in force the powers vested in them, so as to secure the proper sanitary condition of all premises within their district. The securing of good house drainage is an important item in the sanitary condition of any premises, and this necessarily involves the testing and examination of house drains.

Upon a review of all the circumstances, it would appear that whilst in the public health statutes there is no express authorisation of the testing of drains, there is absolutely nothing in the shape of any *veto*. Inferentially tests would seem to be sanctioned, as otherwise how can the local authority perform its statutory duty of ascertaining if the drains of its district are in good order or not?

The nature of the drain test to be employed offers a fruitful field for discussion. Broadly speaking, the test employed should demonstrate defects, if they exist, and should not of itself do any damage in its application.

The Water or Hydraulic Test.—No one will dispute that all *new* drains should be so constructed as to be watertight, when tested under a reasonable pressure. With regard to *old* or *existing* drains, theoretically, they also should be watertight when tested under pressure. The argument advanced by the advocates for the application of the water test to all drains is, in my opinion, a sound one—the contention being that house drains are not uncommonly liable to become choked and obstructed. If the obstruction occurs at the lower end of the drain, then the latter becomes filled with sewage under pressure, and is practically put under a water test. An obstructed drain which allows sewage to percolate into the surrounding soil is a dangerous nuisance. To avoid such occurrences, it is said, every drain ought to be watertight.

Unfortunately in practice, in a majority of cases, the rendering of an old drain watertight generally involves the relaying of the drain with new pipes and new materials in a new bed. I am aware that there is a certain patented method of cementing the interior of old drains without disturbing the pipes in their bed, which claims to render an old drain watertight. I do not know, however, if this method has been generally found satisfactory in practice. Where serious defects are found, and the drain is evidently

in bad condition, and incapable of repair, then relaying is essential, and this may be regarded as the "necessary works" which the owner may be called upon to execute. In such a case, if taken into Court, the legal point is sometimes raised that there is no power conferred in the Acts, enabling sanitary authorities to enforce the substitution of a new system of drainage for an old one—the new system being the modern one, provided for in Drainage By-laws, of inspection chambers, interception from the sewer, and the provision of means of ventilation. In my experience, although the Magistrates are inclined to uphold this contention, they are usually to be convinced of the necessity for ventilation and interception from the sewer, even if they are not prepared to enforce inspection chambers. I do not know of any authoritative decision upon the point as to whether, when a drain is relaid under notice from a sanitary authority, it must conform with the Drainage By-laws or regulations of the authority. I believe it is generally held by lawyers that existing systems of drainage, if not otherwise a nuisance or dangerous to health, are exempted from the operation of by-laws and regulations promulgated after the date of construction of such existing systems, but the case of a "relaid" drain, which is for all practical purposes a new drain, is somewhat different.

The chief difficulty that arises in connection with existing drains is experienced where a drain, although not watertight under pressure, is working well, and is not obviously a nuisance at the time of inspection or examination. Such a drain may be incapable of repair so as to be watertight. There may be no evidence of nuisance in connection with it, and no evidence of danger to health, beyond the fact that it is not watertight. It is doubtful, if under these circumstances, a notice to relay the drain is not somewhat exceeding the powers conferred by any Public Health Act; and this is the view which Petty Sessional Courts are apt to adopt. Theoretically, no doubt, the drain should be watertight, as even although there may be no evidence of leakage when running freely, at some future time the drain may become choked, and then leakage may occur. Where such a drain passes under an inhabited building, and, on testing, it is found that gas escapes from the drain into the building, there is no doubt sufficient evidence of danger to health to justify the service of a notice to make the drain gas-tight, as is now required by statute for all drains under cellar-dwellings in London.

I do not propose to discuss the relative merits of the water and smoke tests for drains, leaving this for treatment by the distinguished architect and engineer who are to follow me; and to them also I must leave the point recently raised, as to the possibility of the water test under pressure

itself doing damage to an old drain and making it unsound. Unless some authoritative statement is made to settle this question, magistrates will possibly in future, if the recent Southwark decision is quoted, incline to regard the result of the water-testing of an old drain as no evidence of defects prior to the testing.

It seems to me that the main question for discussion to-night is as to whether the interests of the public health demand that all drains should be watertight. If this question is answered in the affirmative, the next point to settle is whether the existing statutes confer the necessary powers to enable sanitary authorities to compel owners to relay all drains which are not watertight, even if found to be unproductive of nuisance at the time of examination. If there is a general consensus of opinion that such drains should be relaid, and that the existing statutes do not give the necessary powers, then fresh legislation will be required to meet the demand.

(For discussion on this paper see page 19.*)*

DRAIN TESTING.

By J. OSBORNE SMITH, F.R.I.B.A.

A Truism.

WELL-FORMED drains, with suitable falls and ample means of access for cleaning, rarely cause any anxiety; whilst improperly arranged and badly laid drains are a perennial source of trouble and of danger to health. This observation will be admitted, in an assembly such as the present, to be so true as to deserve the description of a truism, and even amongst the public generally would be accepted by all educated persons. There is, however, a step between accepting a doctrine and carrying it out in practice, and one of the constant tasks of an architect and surveyor is to persuade clients, with willingness, to take this step.

In all cases, to ensure permanent efficiency, the work must be designed on sound principles and the best materials and workmanship employed under vigilant and skilled supervision.

New Drainage.

In dealing with new buildings the treatment of drainage is comparatively simple and direct, and the work should be absolutely watertight and capable of resisting any hydraulic pressure likely to arise in practice.

Speaking generally, it may be said that drains are now being formed with greater skill and under better supervision than formerly, and can be maintained in an effective condition much more readily than heretofore.

Old Drains.

In the case of old drains, however, their examination, testing, and adaptation, cause trouble and anxiety at once to arise. It is sometimes said "Why preserve old drains at all? Remove them and put new ones whenever you alter or add to an old house." This is what theologians call "a counsel of perfection," and if money were no object, this would probably be the course always adopted. But can one always definitely say that this drastic treatment is absolutely essential? We are still in a period of transition and a discussion, such as the present one, will be useful if it teaches us how to secure efficiency without extravagance or waste.

Drains more than say twenty-five years old, even those in connection with well built structures, should be regarded with suspicion, especially when they are inside buildings. Also those of any date in the ordinary speculative houses, particularly in districts where the supervision of the local authorities has been inadequate or perfunctory.

Drains of more recent date, say from ten to twenty years, which have been formed upon a good system may be regarded more favourably; they will not probably be as watertight as new drains ought to be, but they may be, and probably many still are, serving satisfactorily the purpose for which they were intended, and require only a few improvements to place them beyond reasonable reproach. Special attention, must, of course, be given to such drains when within a building.

I know many buildings having drainage of this class which is periodically tested, examined and cleaned, and is for all practical purposes as efficient now as when first formed.

Such drains, if under a building, should stand the severest test which can reasonably be applied to them. For those of this class which are outside the building, smoke under pressure, or a chemical test, is usually sufficient to discover defects which are important enough to need attention.

The application of hydraulic pressure to old stoneware drains tends to further weaken any defective points.

Obstruction.

When a drain becomes blocked by fat, house flannels, or other obstructions, and the sewage is held back for several days, a condition is set up which seriously increases the risk of injury to health.

It will probably be agreed, however, that stoppages in well-constructed drains are not of frequent occurrence, and the risk of harm arising from slight leaks is therefore comparatively small, so small I imagine that the most enthusiastic or timid sanitarian would not for a moment think it necessary to incur the expense of opening up and uncovering drains to trace every slight leak which a severe water test might reveal in the drains of his own house. He would rather exercise a wise discretion, and only act when a reasonable test and examination indicated real and urgent need.

The experience of the Medical Officers of Health will enable them to indicate to what extent leakage from a drain, say three to six feet below the surface of the ground level and outside a building, may be injurious or dangerous to health.

Size of Drains.

The *size* of drains, as we know, seriously affects the character of drainage; small bore pipes are now in favour, but that their indiscriminate use produces nuisances will probably be admitted by all who are practically acquainted with them. Small pipes often mean cleaner drains, but also, on the other hand, greater risk of syphonage of traps. This is a point which should be specially considered when testing.

Position of a Drain.

The *position* of a drain, apart from its vertical inclination, obviously is most important in judging of its efficiency; its proximity to a building, distance below the surface, position in relation to natural strata, made up ground, springs, wells, &c., should receive careful consideration. In short, all conditions and surrounding circumstances in connection with drainage should be regarded from a common-sense practical standpoint.

Efficiency under different conditions.

It is conceivable that a drain, which will not stand any of the usual tests, may, under certain conditions, be efficient for all practical purposes; while another, under different conditions, may satisfactorily hold water and yet be a nuisance.

Hard and fast rules.

I do not think it possible, justly, to apply any hard and fast rules to the testing of the efficiency of old drainage. Careful discrimination, based upon knowledge, is absolutely necessary to arrive at a true estimate of its character. Haphazard guessing from meagre data on the one hand, and reckless application of rigorous, destructive tests on the other, are equally to be deplored.

Reaction.

We have gone far in the education of the general public in appreciation of the importance of sanitary science. We must beware lest, by the extravagance of specialism, we provoke a reaction.

Periodical Testing.

In conclusion, experience clearly shows that the examination, testing, and cleaning of drains, systematically and periodically, are essential to the satisfactory working of any system, however perfect. Windows, floors, flues, fireplaces, cisterns, lavatories and other portions of a building are, as a matter of course, periodically examined, cleaned, repaired, and defects remedied. Just as necessary is it that every system of drains should in like manner be maintained accessible, clean, and in good working order.

(For discussion on this paper see page 19.*)*

DRAIN TESTING.

By W. C. TYNDALE, M.Inst.C.E.

I AM very glad to think that the occasion has arisen for considering this much vexed question of drain testing, for it is one perhaps which has exercised the minds of practical sanitarians more than any other detail in connection with the subject of drainage, and which perhaps has led to more trouble and, even in some cases, to loss of reputation.

My views are supposed to be given as those of an engineer, and are therefore doubtless more in connection with the practical side of the question than are those of the medical officer; but they should not differ in any way, I think, from those of the architect.

The gentlemen who have already expressed their views on the subject

have done so very fully, and it is unlikely that I shall be able to add much of interest to what they have said, but at the same time this is a subject which will bear some repetition of explanation, and it is doubtless desirable that the question should be heard from all points of view.

Thirty or perhaps rather more years ago no one troubled to question the condition of drains at all; they were merely ducts formed in any sort of way, and so long as liquid found its way in the direction in which it was intended to go nothing more was required. The better kind consisted of brick or stone structures, which in course of time became more or less filled with solid matter over which the liquid either trickled or from which it soaked away.

At a later period, drains were made of some class of ware, such as red ware, but it seemed to be generally reckoned that instead of being watertight it was desirable that they should be made with open joints in order that they should convey away the subsoil water if any existed in the surrounding ground.

In 1876 a writer on the then quite new subject of sanitation suggested that it would be better if drains—more especially when they were under houses—were made of stoneware pipes and surrounded with clay puddle to prevent the leakage from the joints soaking into the soil; the idea "caught on," as they say, and since then up to the present time it has generally been recognised that foul-water drains generally should be watertight.

No one I suppose in the present day would deny the desirability or the necessity of a new drainage system being absolutely watertight, and if any so misguided a person could be found, the Public Health Acts and various By-laws, or the law generally, is clear on the point as regards new works.

Admitting this, it follows as a matter of course that some method must be adopted of proving whether drains are watertight or not; the methods of testing are practically only two: namely, that of the smoke test and the water test, but the water test is the only one to my mind which is satisfactory for new work. It is frequently argued that such a test is an unfair one to place on a drainage system, but those taking this view must surely be forgetful of the fact that should a drainage system become stopped up, the sewage will apply exactly such a test.

If it could be guaranteed that no stoppage would occur there might be something in the above contention, but unfortunately it is the experience of everyone who has had much to do with sanitary investigations that drains do stop up, and very often become surcharged almost up to the ground level.

Such a test, moreover, constitutes no hardship for new work, as the constructor of a new system is aware of the conditions under which his work is to be done, that it has to stand such and such tests, he will take the necessary care to insure the results being satisfactory, and this is done every day.

So much for the testing of new work. But turning to the subject of the testing of an existing drainage system, very different conditions present themselves; in fact, the question in this case is fraught with so many difficulties and is capable of so much argument, that it would almost seem impossible to do it justice in the short space of time available.

The difficulties lie in the various interests which are concerned. We have the landlord's interest, the occupier's interest, the interests of the public, the doctors and the engineers. Some of these are conflicting, but the majority of them ought to be in agreement.

The great difficulty lies in arriving at what is right and proper from the health point of view, and at the same time shall not be unfair in other directions. To put the matter in a more concrete form,—we have the tenant of a house, his doctor, his expert—be he engineer or architect—and the local authority, all deeply interested in the soundness of a drainage system, while on the other hand we have the landlord or his agent, or both, who, while not wishing anybody's health to suffer, are keenly interested in avoiding unnecessary expenditure.

The system of drains in question may be comparatively new or of many years' standing; it may have served its purpose admirably for draining away sewage from a house, and in all probability the landlord believes or hopes that the system is free from objection.

Doubts are cast upon it. Perhaps illness occurs, which induces the doctor at any rate to suspect defective drainage. A testing of the drains is suggested. The question is asked on behalf of the landlord what tests are proposed to be made, and he is generally informed that it is proposed to fill the drains with water.

The landlord objects—saying that it is unfair, and likely to make the system which hitherto has been, so far as anybody can tell, sufficiently sound, leaky; the true condition, of course, cannot be ascertained without a testing, and it becomes a question whether the smoke test in this case should not suffice, and whether the application of the water test would not produce defects which do not exist, or aggravate such as do exist so as to render them harmful.

These are the points round which so much discussion lately, both inside the law courts and out, has centred; and while I can say that

I have had nearly thirty years' experience with this matter constantly before me, I must admit that I am unable to suggest any hard and fast rule which should be adopted.

It is undoubtedly hard on any tenant that he should be unable to have it proved to him conclusively that he is not subject to any malign influence from drains; but, on the other hand, it is simply monstrous to suggest that anyone, possibly without real skill in these matters, should be at liberty to apply every conceivable test to a drainage system which, although unlikely, possibly is sound. For my own part, I think that when dealing with an existing drainage system of some or many years' standing, tests should be applied gradually—that is to say, a beginning should be made with the smoke test, and afterwards the water test in sections and without undue pressure should be applied. Such a procedure, while putting no undue strain on a system should yet give quite sufficient indication of the state of affairs, and would enable any open-minded expert to form a very good opinion of the necessities of the case and what really was desirable to be done.

When forming an estimate from a test of this sort, the conditions of the situation of the drains and the soil in which they are laid, should be taken into account, as these must necessarily be large factors in deciding the desirability or otherwise of renewing or repairing the system of drainage.

It is the habit of some persons, whose aim I am sure is rather to make a job than to put matters in their true light, to simply state that a system of drains is leaky without giving any explanation as to how much or how little, often producing in the minds of parties concerned a considerable state of alarm. This is a most unfair, not to say dishonest, practice, as the statement may be that half-truth which partakes of the nature of a lie.

It is much better for an expert to take his client entirely into his confidence, and explain to him exactly the state of the case, at the same time expressing his opinion as to the effect, if any, that the conditions may have; such a course will generally enable the right thing to be done, and much trouble and money to be saved.

It would save much trouble and hardship also if local authorities would observe a little latitude in particular cases, and accept the opinion of an expert of repute instead of always standing out for absolute water-tightness.

Perhaps what I have just said may be construed as an inclination on my part to depart from advocating the necessity for absolute tightness in new

drains, but this is not so in the least. The longer my experience in the matter, the more I see the necessity for absolute soundness and permanent soundness in drains. To me it is aggravating to hear the age of a drain given as a possible reason for its unsoundness, as I always look upon it as a kind of reflection on one's profession, in that we have not hitherto made drains which shall be permanently watertight. If a drainage system can be, and should be, watertight at first, why should it not be watertight for a month, and if for a month why not for a year, and for any number of years? and if it is not so, surely it comes to this, that we have been hitherto using the wrong materials. I have for some long time been of opinion that stoneware drains are not sufficiently reliable for drains under or near a house. It is common experience that no matter how carefully drains have been laid and tested they develop leakage. To what these leakages are due no one can say in all cases, doubtless one reason which has not been sufficiently recognized is expansion and contraction due to varying temperatures in the liquid poured into them. This being so, it is my practice wherever I can manage it to lay all detailed drainage around a building in iron pipes. That this is not considered a very drastic measure is evidenced by the fact that many builders adopt the practice, and I find that even the builders of cheap houses in the district where I live are doing the same. I must say that although I resent the tyranny of many bye-laws, I should not be sorry to see it made obligatory by local authorities to lay all house drains with iron pipes. This, to my mind, is the only way in which healthy conditions of drains may be insured, and all the difficulties which we are met to consider may be avoided.

[*This discussion applies also to the papers by* DR. LOUIS C. PARKES *and* MR. J. OSBORNE SMITH.]

MR. COARD PAIN (Liverpool), in opening the discussion, observed, that he had devoted considerable attention to this subject for the last twenty years, and believed that he was amongst the first to use the water test in this country. It was somewhat difficult to discuss the papers without to a certain extent trespassing upon what had already been said, but he would confine such repetitions as far as possible to what was necessary to the illustration of his argument. He submitted that drain testing is absolutely necessary in order to insure that the materials used and the workmanship are sound. Tests should undoubtedly have relation to the reasonable service which is required of the materials and their

strength. Iron for a drainage system is as near perfection as it is possible to get, but its cost in the country is prohibitive. He did not, however, know that iron is essential, a good stoneware pipe when the soil is satisfactory would serve general purposes, if not called upon to meet exceptional and extraordinary conditions. He would define these exceptional and extraordinary conditions: and as prudent people with every day experience they must realise that in everything they had to be prepared to take some risk, so undue strain from stoppage when the hydraulic pressure gets above ten feet is a condition under which it is almost impossible to guarantee earthenware pipes. Of course, when the pipes are put in concrete they are materially helped. Other extraordinary conditions are subsidence of soil, crushing by heavy traffic where the drain is unavoidably shallow, and the undermining of the drains by water. With regard to tests probably all present would agree that the smoke test is unsuitable for stoneware drains except when pressure is applied. The difficulty in applying smoke under pressure is that the material with which the smoke is produced is liable to clog the outlet pipe of the machine. By the courtesy of the secretary, Mr. White Wallis, he understood that an opportunity of seeing a special air test by machinery was to be afforded those present, and he was very anxious to see the apparatus. Local authorities by adopting inefficient tests often benefit the pay-masters at the expense of the dwellers; the smoke test may be applied by the local authority with the result that a standard of excellence was accorded to the drainage system which very often, if not generally, is entirely undeserved. In making a test of new work it is important that the gulleys and the soil pipe connections should be fixed, for his experience was that more defects exist in the junction of the gulleys than in any other place. As regards the testing of old drains he could not see that any distinction should be made between old and new. If tests are necessary at all—and the doctors must settle the question for them—as to whether sewer gas is deleterious, it is illogical to say the necessity for making an old drain watertight is not as great as making a new one watertight. They all knew how defective drains became dangerous by roots, rats, and saturation, which possibilities emphasize the need for testing. The necessity for perfect drains lasts as long as the occupation of the house lasts. Without testing it is impossible to ascertain the condition of the drain, and it is the duty of the engineer or the expert to state facts and reasons; the owner would then decide what should be done. This last point he was sorry to say often depended on whether the employer or somebody else had to pay. He did not, however, think that where the prevention of disease is concerned the question of cost would influence the decision of a prudent man, and the difficulty might generally be overcome by the adoption of an equitable division of burden between the parties concerned.

Mr. Max Clarke (London) pointed out that the subject naturally divides itself into two distinct parts, namely, what should be required from a new drain,

and what we are supposed to put up with from an old drain. There did not seem to be any question as to what should be required from a new drain, but inside and outside that room there was a great divergence of opinion as to what should be put up with from an old drain. It appeared to him to largely depend as to what the old drain was supposed to do in its time. There are in London thousands and thousands of houses which have been drained within the last ten years which are supposed to be perfect, but through the neglect—he would not use a severer term—of the people who put in the drains, those drains are not what at the present time they should be satisfied with. He thought it was the duty of every expert who deals with these particular drains to apply the water test without any qualification whatever. On the other hand there were old houses in and about London to which it was absolutely useless to apply the water test, because the expert knows beforehand that the drains are wrong, and he does not require any confirmation of that. It was all a matter of cost; everything we do in this world was a matter of cost. Iron drains and their efficacy had been mentioned. In regard to this he would point out that in London there were laid, by the Hydraulic Power Company, mains capable of resisting a pressure of 700 lbs. to the square inch. There was never any question about those pipes leaking, and if it was possible to ensure watertight pipes for hydraulic purposes, it should be equally possible to ensure watertight pipes for drainage purposes. A pressure of ten feet is equal to 4·3 lbs. on the square inch, and this did not appear to be excessive for stoneware or earthenware or iron drains. He had attended that evening for the purpose of having more definite views from the three speakers. They had had three papers, and in neither of the papers had a definite view been given as to what class of old drains should not be permitted to pass. It would certainly be of great advantage to many to get an authoritative definite opinion on this point. Personally every house he had examined had either the drains standing the water test or they were new ones without exception. This was unfortunate in many cases because the people had to pay. Although he had criticised the papers he was very much obliged to the authors for the trouble they had taken in preparing them.

DR. HERBERT W. G. MACLEOD (London Hospital) contended that the question of the period at which tests should be made was of equal importance to the question of how tests should be made. He pointed out that from a variety of causes drainage systems are liable to get out of order, and especially was this the case with houses built upon made soil. After a few months the made soil subsides and the drainage system gives. In his view these are circumstances demanding that a test should be made say six months after the work has been completed. He hoped the importance of this second test would be admitted. In the neighbourhood of railway-tunnels and cuttings, for instance, the drainage systems of the houses were specially liable to get disordered, the continual jar and vibration would weaken the foundations of drains, and cracks would appear,

or dislocation of the jointings. The frequent testing of drains in these houses was obviously necessary, and the advantage was apparent.

Mr. George Chambers (Ealing) said that with previous speakers he had failed to see the difference between the testing of old and new drainage. If it was necessary to have a new drain watertight, it was necessary that old drains should be equally watertight. From a health point of view nobody could deny this. He would of course make a distinction between rain-water drains and sewage drains. He would allow a fair amount of leakage from rain-water drains, but would not allow a particle from an old drain conveying sewage any more than from a new one. He would have no mercy on the landlord because the engineer who advised had to take all the risk. In his opinion the smoke test was a waste of time. Under the present building bye-laws it was necessary to put six inches of cement or lime concrete under the floor, and it was folly to expect that smoke would filter four or five feet under the soil and through six inches of cement or lime concrete on the top of that. The only test that could be safely applied to drainage was the water test or the air test. The water test should be adopted for all drains under the surface, but above the surface he would adopt the air test for all soil and ventilating pipes. He agreed that drains should be tested before they are covered in, and also on the completion of the work. Not only that, but they should be tested at least six months after the work was completed—a plan adopted by the late Mr. Rogers Field, whose work was known to be of such an excellent character.

Mr. Isaac Young (Chief Sanitary Inspector, Battersea) said that unfortunately he was not present at the earlier part of the proceedings, but arrived in time to hear Mr. Tyndale's paper. He agreed with many of his views, but with some he did not agree. He drew the line at one particular question. Mr. Tyndale had emphasized the necessity that a new drain should be watertight, but if that was necessary, and no one would surely question it, it was equally necessary that an old system should be in the same condition. He represented a large body of officers engaged in carrying out the provisions of the Public Health Acts both in the Metropolis and in the Provinces, and he hoped the meeting would not close without some definite pronouncement as to what attitude sanitary authorities should take in the future on this important subject. Executive sanitary officers required some guidance, although they had doubtless made up their minds as to what is necessary. If an old system of drainage would not stand the water test, his own opinion was that the sooner it was removed and a watertight structure laid down the better it would be for the tenant of a house and the health of the community at large. Another point however was highly important, viz., as to what distance should they require a drain outside a house to be watertight, and whether in its entirety or not? Ninety-nine per cent. of the smoke tests in his experience had been found to

be more or less unreliable, for in many of the houses they found the drains were not properly intercepted from the sewer, and the consequence was that the smoke in testing simply passed into the sewers. He agreed as to the period at which drains should be tested, namely, in sections while they are being laid, secondly at completion, and subsequently wherever possible some months afterwards.

MR. J. HUMPHERYS (Reigate), referring to the paper of Mr. Osborne Smith, took exception to the description, "speculative builders' houses," and said in these days of the development of residential districts it was difficult to discover where the element of speculation in house-building did not come in. His experience was—and he believed he was speaking on behalf of his brother officers—that 99 per cent. of the sanitary improvements effected were paid for by the tenant. They were certainly all agreed that there should be only one form of drain, and that must be a watertight drain, and there can only be one test. He thought the duty of sanitary officials was clear, that they must insist on watertight drains, and they hoped The Sanitary Institute would come out and assist the local authorities in this important work.

MR. G. M. PETTIT (Kensington) said that he had come that evening to hear what Dr. Parkes had to say as to the testing of drains, and as to whether they should be watertight, old or new. The Institute had granted the sanitary inspectors their certificates under which they held their present appointments, and he had always been taught by that Institute that drains should be watertight. As a sanitary inspector he could not prove that a defective drain was dangerous or bad for health, but he could prove that it was a nuisance. The question of injury to health was a question for the doctors, and he would ask Dr. Parkes to tell them, in replying, whether a defective drain was or was not a nuisance, and if it were a nuisance whether it should not be remedied and made watertight. He did ask that Institute to give them some guidance in this matter, in order that when they took legal proceedings they would know what line to take.

THE CHAIRMAN (Prof. W. H. Corfield, M.A., M.D., F.R.C.P.), in closing the debate, said that there were some sanitary authorities, both in London and the country, who did test that part of the drains between the interceptor and the sewer, but he did not think that they could expect this practice to be adopted by all the authorities at once. In regard to the water test the proper practice was that new drains should be tested with water: firstly, as soon as they were laid; secondly, after they had been covered in with concrete; and, thirdly, after the trenches had been filled in. It was a good plan, and made builders careful, to advise them beforehand that their drains would be tested on these three occasions before the work was passed. If that intimation were given, they would find in 99 cases out of 100 that the work would be satisfactory. With

regard to the smoke test this had been condemned by most speakers. Now, the smoke test was most useful for ascertaining whether a drain was unsound, but it was of no use for ascertaining whether a drain was sound; that was the way in which he would put it. It stood to reason if a drain did not hold smoke, whether under pressure or not, that it was perfectly unnecessary to apply the water test. The question had been asked: Did the water test damage drains? He believed the statement that the water test damaged drains was a pure bogey. He could tell them of some drains the water test would damage, namely, drains with clay joints, even if watertight when laid, and he said it was impossible to lay a drain with clay joints that would remain watertight. Such a drain would be damaged by a water test, and the sooner it was damaged the better. With regard to drains having cement joints, if they were sound the water test never did them any harm; but he admitted that a defect might occasionally—but only occasionally—be exaggerated by the water test by the removal of a loose bit of cement from a defective joint. What was the harm in that? If there were a defect the sooner it was exaggerated the better. Did sound drains become leaky? Well, he was sorry to say they did; he was sorry to say that stoneware drains, which for various reasons he preferred to iron drains, may become leaky. The reason he preferred stoneware to iron was that iron was an alterable material, and it was contrary to scientific and sanitary practice to employ a material which one knew perfectly well was destructible by moist air or by water, merely coating it with some protective material to try to prevent such destructive action taking place. There were circumstances, however, in which it was advisable to use iron; for instance, drains under houses were better made with heavy iron pipes, especially where settlements were likely to take place and extra strength was therefore required. Should the soil drains outside houses be sound? The Chairman then quoted at some length an interesting case showing the need for testing outside soil pipes, the water supply of a house having become contaminated in a singular and most unexpected manner. Wherever the drinking-water of a house was in any way connected with the drains, it was necessary that the drains inside and outside a house should be perfectly watertight. In fact, the more he saw the firmer was his conviction that any sanitary adviser undertook a very serious responsibility if he sanctioned his clients living in a house, the drains of which were not watertight. In relation to the smoke and water test, in his opinion all new soil pipes should be tested with water, no matter how high the buildings were. He invariably insisted on this being done. Sometimes he advised the testing of old soil pipes with water, but generally it would be found that the chemical or smoke test under pressure would be sufficient for old soil pipes. With regard to the rain-water drains, if they were not even indirectly connected with soil drains, it was not so important to have them watertight, but if they had even a direct connection with the soil drain it was quite necessary that they should be watertight, as sewage might get backed up into them.

DR. L. C. PARKES (London), in his reply, explained that the original title of his paper was the "Testing of Drains from the point of view of Statutory Enactment." That title was altered to meet the views of the Committee. His paper was written from the point of view of statutory law, and how far a water-tight drainage can be enforced. His view was that the existing Acts did not enable the sanitary authority to compel all drains to be watertight. His own view was that if sanitary inspectors were not prepared to state in court that a drain was actually a nuisance, then there were not sufficient grounds to put the Acts in force. Sanitary officers were very much at the mercy of magistrates, who had no expert knowledge of these matters. Magistrates listened to both sides, and did not necessarily take the view of the sanitary authority. Unless the evidence went to show that a drain was actually a nuisance magistrates were extremely likely to dismiss a case, in which it was sought to compel the laying of new drainage. If this condition of things should not, in their opinion, prevail any longer, it was the duty of the societies which they represented to petition Parliament, when any further legislation on the subject was brought forward, to have it clearly enacted that all soil drainage in or about a house should be watertight.

MR. J. OSBORNE SMITH (London) said the discussion had been extremely interesting to him as a practical man. It was utterly impossible for anyone to be always quite sure that a drain which had been laid with every care would be perfectly sound for all time. He agreed with the Chairman that new drains ought to be tested three times, but in some situations it was difficult to form drains which should always continue to be sound enough to withstand a severe water test. A slight leak did not, in his opinion, *necessarily* reduce the efficiency of a well-made drain. He pleaded for the exercise of a sound judgment upon facts, indicated by reasonable testing of old drains, instead of the hard and fast rule of applying the severest known test without discrimination. What he had heard that evening had not altered his opinion as given in his paper. With regard to Mr. Humpherys' remarks his words had been misunderstood; he did not say speculative builders' houses, but "ordinary speculative houses," which was a different matter. He was afraid that if local authorities sanctioned unreasonable and too exacting conditions as to drainage systems there would set in a reaction which would impede sanitary reforms.

MR. W. C. TYNDALE (London) said that as a reader of one of the papers he had been rather twitted with not having laid down the law as to what was and what was not a good drain. He would not take upon himself to be dogmatic upon a point which had occupied the Law Courts so much, and upon which there was so much difference of opinion. There was no unanimity of opinion in that meeting itself. He had taken that opportunity to make it clear what his views were as regards old drainage and what as regards new drainage. He spoke with no uncertain sound as to what should be done and applied to new drainage. In the

case of new drainage no hardship was entailed by severe tests, as the persons who paid for such drainage knew exactly what was required even before such drains were designed. With regard to old drains other interests were concerned, and with English fairness he thought they should look at the matter from more than one point of view—more than from that of the person who tried to show that the drainage was not sound. A certain amount of consideration must be shewn to those who had to bear the expense. Besides there was considerable doubt as to what was and what was not dangerous in the state of a drain, and it did not follow that because a drain was defective it was a nuisance. In these cases they must look to the medical fraternity for a definition, and various factors—such as the structure of the houses, the existence of a basement, and other things—would have to be taken into consideration; otherwise enormous hardships might be imposed on persons owning property. He had spoken particularly of iron drains, though it was quite true, as the Chairman said, that as a material for drains, iron was not so good as stoneware; however, he was quite certain that there was not a man in the room who, after laying a drainage system absolutely sound and with every care at the time, would be prepared to guarantee that it would be absolutely watertight after a certain period. This being the case, why should not a material be used which could to a certain extent be guaranteed, and thus avoid the enormous difficulty which the leakiness of stoneware drains involves?

Mr. Isaac Young then moved, "That this meeting of The Sanitary Institute is of opinion that all systems of drainage for conveying sewage should be capable of resisting a pressure of at least two feet head of water." He said that personally he should have preferred to have had a higher pressure of water for a drainage system conveying soil, but he had in his mind the bye-laws which govern the metropolis, and made by the London County Council under Section 202 of the Metropolitan Management Act, and one of which bye-laws specified two feet head pressure. He thought that might be generally considered sufficient, and would be adopting a reasonable standard quite sufficient for present purposes. He sincerely hoped the meeting would carry the motion.

Mr. Coard Pain seconded this proposition, which he said had been most admirably put and was of a practical character. It brought testing within reasonable limits. It might be difficult to carry it out, but the idea was excellent. He took the opportunity of supplementing his previous remarks by adding that he did not consider anyone present would be so unreasonable as to condemn a drain laid and tested, say twelve months ago, because a slight leak was observed, and that possibly under considerable pressure. Such leaks under the suggested test of two feet head of water would probably not be apparent.

The resolution was put to the meeting and carried with one dissentient.

DISCUSSION ON APPLIED HYGIENE FOR SCHOOL TEACHERS.

(Arranged by Bedford College for Women and The Sanitary Institute.)

Opened by

Prof. C. S. SHERRINGTON, M.A., M.D., F.R.S.

January 21st, 1903.

The Chairman (Mr. M. E. Sadler), in opening the proceedings, said the subject for discussion was very interesting and of great practical importance. The science and art of healthy living was a branch of education specially interesting to the English people. The greatest tribute to sanitary education ever written by an Englishman might properly have been read at that conference: "A sound mind and a sound body is a short but full description of a happy state in this world; he that hath these two has little more to wish for, and he that wants either of them will be but little the better for anything else." If a parallel be sought in this country for the long sustained effort of public spirit and munificence which have rebuilt the educational organisations of France, Germany and the United States within the last one hundred years, we have to turn to that great movement for sanitary reform which has absorbed so much of the best energy and talent in England during the same period. Our English devotion to school games and to physical exercises in the open air is having a profound influence on the educational ideals of every other country at the present time, but we ourselves need to deal with this matter of education in the laws of health in a more systematic way than hitherto. In this as in so many other departments of our national life, do we not need to push our practical handling of the question to a much higher point of scientific thoroughness, without losing the spontaneity of individual effort? Good physique is essential to the greatness of a nation, and enquiries such as those made by Mr. Rowntree at York, and the article by General Maurice published in this month's "Contemporary Review" cause us great searchings of heart as to whether the physique of the English people is being maintained at the high standard necessary to our future national welfare. The new note in education is the social note, and he pleaded that we needed to study hygiene in schools in order that we may impress the rising generation with a deeper sense of the urgent need of improving the conditions under which so many of our people live. We must seek to arouse a feeling of horror against slums and against the evils of drink and overcrowding, and promote a strong sentiment for happy healthy homes and towns.

Prof. C. S. Sherrington (Liverpool), having expressed regret at the absence of Miss Ravenhill, said he could not adequately fill her place be-

cause she would have illustrated her remarks by a wealth of practical point obtained by first-hand acquaintance with the conditions of school life to which he could not lay claim. His remarks therefore would have to be of a general character. Engaged in an ever increasing work he approached the subject with a profound conviction of its importance, but always as it were from the outside. The point of view that repeatedly arose to his mind was the point which for want of a better phrase he would describe as the "Naturalist's" point of view. Although Darwin confined his studies and theorising to plants and animals, his views were soon extended by thinkers who followed him to problems surrounding all the activities of human life. There exists in fact a natural history of man, and the evolution of man is being every day evolved before our eyes. We are apt to take that fact so much for granted as to forget a part of its significance. Swept along in its current ourselves, unless we pause to think about it, we hardly perceive it more than we perceive the motion of the earth to which we belong. If the naturalist is asked to-day what the functions of living beings are, he includes as one of the most important of them the adjustment of themselves to their surrounding conditions. If they do not so adjust themselves they perish; when the change in their surroundings is rapid the adjustment must be rapid. The rapidity of change may be too great for a number of individual species to follow; these then begin to suffer, to be disseminated, and to perish. Speaking of the rapidity of change, time was regarded in the naturalist measure as geological time; its periods are of another order of magnitude to those with which we are accustomed to deal in history. In the history of natural species, a thousand or ten thousand years is really but a little time. Now man influences man, man is a social being; the conditions surrounding man the animal largely consist of conditions made by himself and other men. Where man the animal is concerned, the stream of change is in comparison with lesser things running like a mill race. What do eighty generations count say in the history of a primrose or cowslip? but eighty generations ago men were hunters and herdsmen sheltering in wigwams and caves. We are apt to forget this fact unless we take the book down from the library shelf. At that time our bodies were painted green, but note the change in eighty generations. The solitary forest has given place to towns with buildings called houses. The pure air of the forest is exchanged for the exhalations of ten thousand chimneys, of hundreds of thousands of human beings, and of hundreds of thousands of gas burners. The water of the river had become a thing so precious as to be contended and fought for by huge communities, and its sources of supply, if not carefully guarded, contained dangers which threatened thousands of human lives. We are thus reminded of the conditions of human life, the conditions of man the human creature have been and are being changed with enormous speed. Only the greatest care can mitigate the suffering that the naturalist perceives must accompany this rate of change. The normal child is born with inherited tendencies for the life his or her ancestors lived for ages and ages—the life of

the semi-naked hunter, of the fisher and the shepherd. The child of to-day is born, as Tommy Atkins might say, "a bloomin' savage," and it will be long ere he is moulded to the comparatively freshly arisen laws of modern life. Now-a-days every child has to go through his measles, whooping cough, scarlet fever, and what not, and all the other kindred early conditions necessary to enable him to earn his daily bread. We can hardly estimate the enormous individual strain upon the muscles and nerves of the eyes and upon the eyeball itself and part of the brain that depend upon the eyes by the enormous change occasioned by reading and writing. Conversely these modern occupations render inactive some of the other organs of the body—the chest and lungs, upon which in past times the success of the bread-winner of the family depended. What hereditary capacity can our children yet have for meeting such strange conditions? They are not yet born with an organization enabling them forthwith to speak, let alone to read and write. Now to bring this child, an immature hunter, fisher and shepherd to maturity, we must remember that from his point of view our conditions are artificial and unnatural, and this seemed from the broad point of view to embrace the problem covered by the hygiene of school life. Of course hygiene is, and always should be and must be in its greater part, personal. It is not a public but an individual matter. "Hygiene," says the syllabus issued by The Sanitary Institute, which is really doing so much for the cause that we have met this evening to promote, "belongs properly to the training of the home." We in this country are notoriously adverse to public people coming into our home life, that is one of the difficulties besetting the sanitary officer, because people seem to prefer a certain amount of dirt and ill-health, and to bring them under sanitary supervision means some restriction of individual liberty. Now health is of imperative importance in the formation of character, and it was to be remembered that the children to-day are the citizens of the future. The personal surroundings of the child are best entrusted to the intelligent parent. He could not help thinking that they would all be agreed that the centre of gravity with this question lies naturally with the primary schools. The children of the well-to-do, on the whole, are taken care of hygienically, but the conditions obtaining for proper health precautions are so difficult, so severe, and so hard among the poor, and among these children dealt with in the primary schools, that it is there we have to make our greatest advances. Now, although the child's health and well-being is best and properly entrusted in these matters to the intelligent parent, there is in many homes no intelligent parent, and so much of the child's life is absorbed by school that the maintenance during the school hours of the principles of health as far as is possible is most important. Often a child's advance against physical and other evils must lie more with well-chosen and well-instructed teachers than with ill-instructed and careless parents. For nine months in the year during the period of the formation of the body when mind and body are most impressionable, home life fades into the back ground, and school life holds sway. On the school rests the responsibility of preparing

the citizen for the performance of his paramount duty. Healthy thought is dependent upon a healthy brain, and unhealthy thought is due to an unhealthy brain, and in consequence the principles of health are important, because the conditions of school-life should be especially for the poor. In these matters teachers should be more profound and skilled than are those of most parents, especially among those of the less educated classes. Now the hygiene of most of our schools is bad; there is bad ventilation, bad light, impure drinking water, no proper means of drying wet clothes, even boots and shoes, and one could add many practical instances to prove the point. Now he wished to put before them a suggestion as to how the difficulties could be met. What method can be properly employed? One step had been suggested, and in many cases taken, that of medical inspection. In Germany, France, and in many States of America, as well as in some of our own districts, medical men inspect the schools. They pay in some cases tri-weekly, weekly, and some fortnightly visits to the school, and report to the managing authority the condition of the premises and the health of the children. In some places in New York the Inspectors are under a Chief Inspector, and many considerations indicate the desirability of increasing this medical inspection of our primary schools. The question very naturally arises as to whether such medical inspection should be a part of the Education Authority or a part of the Public Health Authority. That is a matter for discussion. They would all say that the most important duties for medical inspectors of schools are certainly very different to those performed in general by the Medical Officer of Health. The functions of the medical school inspector are of a special character, dealing with such subjects as the dissemination of infection, the aggregation of children and teachers incident to any school system. The ordinary practitioner was not particularly well equipped for overseering work of this kind, and if the expression could be allowed "he learns too little physiology." Certainly his knowledge of physiology is the reverse of profound as acquired in our medical schools of to-day, still less is our ordinary medical practitioner instructed in the co-relation of the brain and other activities of the body. Now it would be possible to suitably train medical men by a simple modification and addition to their medical curriculum; thus the system of medical inspection, though desirable, can only profitably go hand in hand with a concomitant step. The daily visit would be objectionable besides being expensive, and this daily inspection as a rule is unnecessary; but what is needed is to have the skilful and earnest co-operation of those who were at the school every day, namely, the teachers. Only the teachers could afford the medical inspector this intelligent co-operation; hence the teachers themselves should be sufficiently trained in the laws of the living body and the principles of health in order that they could assist the medical officer regarding the children under her care as the hospital nurse helps the physician with the sick and suffering in our hospitals. This is not really an extraordinary task for the teacher. The laws of health are in one respect like the laws of the land, easy to

obey though difficult to investigate. Many teachers have been well trained in chemistry and physics. The laws of the working of the healthy body are the same as those of chemistry and physics in their relation to the living animal frame in its wear and tear. Teachers might proceed, he would suggest, from their physics and chemistry to physiology, and learn how to apply it by common sense in their schoolroom, not forgetful that in any points of difficulty they can appeal for counsel and help to the expert medical adviser outside.

PROFESSOR ADAMS (University of London) said this subject was not his specialty. He had given more attention to questions of intellectual or mental fatigue. He thought no one is more keenly alive to the hygienic conditions of our elementary schools than the teachers in those schools. Whatever the government or the School Board may think, he believed that on health questions the teachers in the elementary schools are sound. Sometimes the inspectors are sound too—foolishly sound. Some people who have not been in elementary schools speak of them as if they are hotbeds of infection, but there could be no stronger argument used against that than the ratepayer who described the Board Schools as palaces. In the newspapers these buildings were described by the ratepayers as palaces, but it was to be noted that they did not call the teachers princes or kings or queens. Now there could be no stronger argument in favour of maintaining these palaces than the argument of providing better homes for the poorer or working classes whose children had to spend practically their living day in these schools. For something like eight hours the children were under the influence of school conditions, more or less, and therefore hygiene is essentially a matter of concern. In the North the elementary school system of ventilation is generally admirable, and in Scotland the first place they take a visitor is downstairs where the ventilating machine is placed. Now and again that machinery did not work, but it was designed to supply hygienic conditions and to promote health, and that is the meaning of the Conference which they were holding. It is because they felt a want of knowledge and know the value of it, that they had gathered there that day.

MRS. DICKINSON BERRY (London School Board) said that the improvement in the physique of girls due to physical education was very surprising, but this improvement she feared was largely confined to the children of the upper and middle classes. The development of physical education is very far from having extended to the girls of the lower classes as one could wish to see it. The Technical Education Board of the London County Council had for a good many years taken a step which, so far as she was aware, no other body had done in England as regards school hygiene, namely, that all those children who get scholarships are medically examined. A yearly report is presented to the Board by the medical examiners, and in this way records of the physical condition of the children, their weight, height, &c., are kept; suggestions as to

treatment in special cases are also made. She had been much impressed recently by the poor muscular development of many of these girls; there were many cases of weak back muscles causing a tendency to lateral curvature of the spine. It seemed to her that one of the most important hygienic conditions that they ought to have in connection with elementary education is gymnasia. At present, so far as she knew, the London Board Schools provided little if any gymnastics for girls. Of course gymnastics could be obtained at the Polytechnics, but there ought to be a gymnasium in connection with each elementary school. The swimming in Board Schools had benefited a large number of children and indicated one direction in which they might move. Drill of course is given in most schools, but not that definite gymnastic exercise that is requisite.

Mr. A. Wynter Blyth (Chairman of the Council of The Sanitary Institute) complimented the authorities of Bedford College in having come to the front in endeavouring to promote hygienic knowledge, thus setting an excellent example to other educational authorities. The immediate subject of the discussion was "How to train teachers in hygiene?" The scheme set forth in the syllabus jointly published by The Sanitary Institute and the Bedford College seemed admirably adapted as a basis for theoretical knowledge to be followed by practical application. The application of that theoretical knowledge was the most serious difficulty, and they were not told in the syllabus how to impart that practical knowledge. In The Sanitary Institute in the earlier period of its career they taught more or less theoretically, but now they attempted to teach practically; and in the same way he hoped ultimately the teachers would be educated in practical hygiene. The development of this idea would, no doubt, have to be on somewhat different lines than those on which theoretical hygiene is based. As a medical officer of health he could generally trace a case of scarlet fever to schools, and the circumstances invariably were that the school was infected from an unrecognised case. The public health service really required that teachers should be able to recognise infectious disease in its early form and to diagnose common infantile maladies. Now, there were many infectious diseases which do not come under the law with regard to notification. For instance, there was school ophthalmia, which had caused an immense amount of suffering and mischief. It was impossible for a medical man to inspect daily all the children in a school to see if they were suffering from ophthalmia; the teachers themselves should know something about such an infectious disease and should be able to detect or have some suspicion that their pupils were suffering from school ophthalmia. There was another branch of this subject, and although it is an unpleasant branch, it was important to refer to it, namely, the uncleanly state of many of the poorer children. He knew for a certainty that a large percentage of the school children in the board schools of London had dirty heads. Now, that was a serious thing, and—as was done with people who entered hospitals—there ought to be some method of cleansing children before

they entered the school. These were subjects of practical moment upon which teachers required guidance and instruction.

MISS CONNOLLY (President of the Head Mistresses' Association) related her experiences of the Haberdashers' School at Hatcham, and explained how in time she had been enabled to improve its hygienic condition, and in fact to obtain a new school. In order to do this she had attended the classes and lectures at The Sanitary Institute for a whole year, and with the aid of her brother (Dr. Bloomfield Connolly), who was a medical officer of health in a large garrison town, she had been able to improve from a sanitary point of view the designs for her school. The result was that the sanitary authorities did not trouble about her school. There was no possibility of sewer gas coming into the building, everything was disconnected, and there was not a pipe under the building. Drinking-water was fresh from the main, proper ventilation was provided for, and ample space was provided for the girls. Added to these questions which affected teachers, there were questions of school food, school clothing, and school habits. Reference had been made to the intelligent parent, but the intelligent parent did not grow on every bush. Miss Connolly's experience was that mothers sometimes neglect their children for other duties, and children were sent to school improperly fed and clothed. Teachers were alive to these facts; although they could not bring the responsibility home to the parent they could do something by being alive to the evils, watching especially for brain fatigue, and generally maintaining a salutary influence over their pupils.

MR. W. SCOTT COWARD (H.M.I. Training Colleges) expressed the opinion that what was required was some systematic method of training the teachers who shall in their turn teach the children. It was important also that a beginning should be made to improve those schools in which the hygienic conditions are most defective. He did not hesitate to say that a large number of the voluntary schools in this kingdom fall very far below a proper sanitary level. They furnish the slenderest equipment for the maintenance of proper habits and for the creation of a proper condition of health. The lighting was often extremely bad and in many other respects defects existed. This was a most unsatisfactory state of things, and every effort should be made to bring the state and the necessities of these schools home to the new educational authorities in order that they might raise up this low level of the elementary schools of the country, especially in the rural parts of England. The question of suitable premises was of vast importance. With regard to the board schools in large towns their condition was satisfactory, and there is no doubt that a considerable number of voluntary schools were faithfully fulfilling their duties in this respect. He was, however, prepared to maintain that a very large proportion of the schools to which he alluded were not in a satisfactory state with regard to the elementary conditions of hygiene.

The means of spreading hygiene in schools among the children must rest with the teachers, and provision must therefore be made for the training of the teachers, and on this he could say very little indeed. The present instruction given in hygiene was so strictly scientific and so purely academic as to be of little, if any, practical use. The instruction given in them is so extremely dry and tedious that the study of it became unattractive. Now the first thing to do in our training colleges was to institute some sensible method of teaching hygiene. He ventured to think that the less time they devoted to this dry science the better, and that it would effect the object more fully and enable the students to see that there are certain practical conclusions which have been come to by scientific men in regard to hygienic subjects, based upon careful research. Those conclusions must be accepted and the teachers must popularise them. If this were done they would be able to create interest, and the teachers would go into the schools armed with a number of principles, and furnished with the means of illustrating in a popular way those principles. They would then begin to apply them and make them real. The present system is a delusion so far as any practical effectual teaching of hygiene is concerned.

Dr. H. R. Kenwood (Medical Officer of Health for the Borough of Stoke Newington), pointed out that the speakers hitherto had mostly confined their remarks to the duty of the school teacher in guarding the health of the scholars while at school. He was, however, one of those visionaries who saw, in the near future, school teachers teaching all scholars the elementary principles of health, and instructing all girl scholars upon their main duty in after life, *i.e.*, that of infant rearing. As a medical officer of health he could bear testimony to the enormous amount of preventable infant mortality which occurs in this country. We who are in the van of sanitary progress suffer 25 out of every 100 children who are born to die before they complete one year of life. Dr. Wynter Blyth would agree with him that a large proportion of that mortality is easily preventable, and is due entirely to ignorance. He believed there was a great work to be done by school teachers in this direction when our educational system can make room for the teaching of such an important subject. It will be a great duty and a great privilege for the teachers to educate the rising generation on the essential fact which will enable the people to prevent much disease and premature death. It is only by getting children when they are young and teaching them the principles of health that we shall be able to effectively cope with the parental ignorance which is responsible for such a large amount of mortality, and for such a tremendous amount of sickness every year in this country. The chairman had explained how needful it is for us to have physical strength owing to the stress and difficulty of life at the present time; all would agree that worldly success at the present time is impossible unless a man or woman has physical well-being at the same time. Therefore, for his part, he had rather put this knowledge of science of health before the reading,

writing and arithmetic taught in the elementary schools. It should not be a question as to whether there is room for the subject of elementary hygiene and infant rearing in our code of education, but as to what else there is room for. The great difficulty in teaching children hygiene is the difficulty of presenting matters properly, *i.e.*, intelligibly and interestingly. This, however, could be done by a scheme like that of Miss Ravenhill's, which *almost* meets the difficulty; by providing a series of object-lessons which are constantly being given to the children, and by the avoidance of scientific terms the subject can be made to appeal to all. By these means the children are taught the benefits following the application of certain health principles, and the ill-health and diseases which follow if these principles are not observed. But if children are to learn there must be somebody to teach them. This is the difficulty at the present time. The Bedford College is doing a very good work indeed, in association with The Sanitary Institute, by making an effort to prepare teachers to convey this essential knowledge. Everybody present would wish the two Institutions the best of success in their important and very useful work. Of course, adequate knowledge must be possessed by the teacher, and this should be tested by examination. The certificate provided by The Sanitary Institute is one of an essentially practical nature, and those who conduct the examination for that certificate are men who represent almost every phase of hygienic and educational knowledge combined.

DR. J. KERR (Medical Officer to the School Board for London) observed that there are two notes in education that to him seemed new: one, of the physiological aspect, and the other, of the value of the education of a child as a civic unit. State provision is made to compensate for many of the disadvantages which civilization has entailed. The State provides for the artificial conventions which are useful to its members, but has hitherto neglected too much those natural physiological requirements which are absolute necessities if the child is to develop into a healthy and well-acting citizen. According to the old mediæval idea the school was a place where the children should be prepared to take part in the services of the church, and that idea is still hanging about the educational atmosphere. A few years ago there were educational people talking about teaching the three R's; he thought however that we had passed the three R stage, and had come to the stage when the three R's were regarded as not so very valuable, and that there were other things of much greater weight; for instance, we have begun the separation of children who are incapable of benefiting from the three R's, but there is still that large class of dull and backward children who are not legislated for, and who at great cost and waste are kept in schools working at the three R's when they might be doing something very much better. These things point to the prospect of high ideals being established in the immediate future for educational requirements. The idea of a vague and general efficiency has given place to the idea that we must

educate every function of a child, and we must see that in its education the child's treatment and its surroundings are all hygienic. It appeared to him that in carrying out these ideals the teachers do their best at present—he was only speaking of the elementary schools—in fact, they would carry out instructions with more accuracy and zeal sometimes than one wanted or expected. But if we are to have medical inspection of schools the system must be carried further, and inspectors with hygienic knowledge appointed. Undoubtedly the new Act would lead to the appointment of a large number of inspectors under the County Councils, and women who have taken up sanitary studies will, with their sympathetic ways of looking at various aspects of a question, no doubt in a great measure come to occupy these posts. It will have to be in some such way that the hygienic conditions of schools and school work will be ruled and regulated and made to comply with the modest requirements of the Board of Education, for their minimum is for many schools the maximum to be attained. There are a large number of schools whose hygienic attainments are good, but even these attainments will have to be improved, and for nearly all schools the requirements must be raised to accord with the principles of modern hygiene. In the schools, that which passes almost unconsciously before the children's eyes helps to form their character, and if the schools are dirty and the teachers are careless the children are adversely influenced. It seemed to him that in the schools there is the possibility of invading the home and making it sanitary. Only by development of the sanitary conscience in the children can we hope for a great improvement in the future. This developing of the sanitary conscience can only come directly through the teachers; doctors, sanitary inspectors, and nurses are all futile. It did not matter much how they began with the training so long as it is made necessary for every teacher to have some sanitary education as part of their curriculum, and a requirement before they can obtain their certificate. Then the word will be given and the dry bones will become actual and living substance. Thus the teachers will carry the atmosphere of practical living into the schools to develop the sanitary conscience that we want for future generations, to create sanitary homes all over the country, resulting in the standard of the people and the units of the nation being improved.

Miss Robertson (Bedford College) observed that there was one aspect of the question which appealed to her most strongly, and that was how teachers were to be awakened to the importance of the subject. Prof. Adams had remarked that the teachers in the elementary schools in this respect were sound, but Miss Robertson was not sure that this was true of the secondary teacher, who was apt to think that she had only to deal with the intellects of her children. There were two facts she would like to impress upon every teacher, and especially upon every young teacher: one was that it was so very rare to find a girl well developed physically who was not active in mind as well as in body. Miss Robertson did not mean that the girl would be necessarily

active in her work, but she would be active in something, it might be play or mischief if not in work. It was not difficult to deal with such a girl; if the teacher had common sense and ordinary skill she could make that girl work by a judicious application of pain or pleasure. But if it were a question of a thoroughly listless, indolent girl there was real difficulty, especially if the teacher did not realise that this listlessness was owing, to a very great extent, to physical causes. Miss Robertson, in support of this view, related an experience of her own of a girl of this character, and said that had she recognised the true source of this listlessness, her treatment of the pupil would have been more successful. The other point she desired to impress upon teachers was that many of the difficulties of discipline, especially in the younger forms, might be avoided by the recognition of the value of good hygienic conditions. This was proved by the alacrity and precision with which a class of troublesome and inattentive children would stand up and do, according to command, a few physical exercises. This showed that there was no deliberate inattention on their part, but that there was real physical inability to attend. A teacher had told her that she believed that the good discipline maintained in her school was due to the fact that the children changed their classrooms every hour. The girls came back fresh to their fresh rooms, they had had relief from their sitting posture and work went smoothly for the next hour. Here Miss Robertson thought it would be possible to get hold of the young teacher who was probably anxious to acquire the mysterious power of discipline. If such a teacher could only be made to think that attention to physical conditions could help her she would never neglect them. These facts, however, had to be pointed out to her, and Miss Robertson said that it was at this point that the headmistress could help. Headmistresses sometimes seemed to think that if due regard were paid to hygiene in the construction of the school buildings and in the choice of school furniture, that their responsibilities were at an end, but Miss Robertson did not think she was exaggerating in saying that quite half the teachers did not understand how their rooms were ventilated, or how the various apparatus should be adjusted. Now that professional training was being more and more recognised the rising generation of teachers would be more alive to the points which had been discussed, and that the necessity for care and attention to the hygienic condition of schools would be fully recognised.

MR. J. RUSSELL (Headmaster of the Hampstead School of the King Alfred School Society) remarked that if he could not speak as an authority on hygiene, he could at least make a frank confession and take the conference into his confidence. He had been a schoolmaster for twenty years, and he looked back with much regret at his failure to do the best for his boys from a physical health point of view while they were under his charge. For that failure he held himself partly to blame, but only partly. Primarily the parents of England were to blame, secondly the headmasters, and thirdly the Government, or the State, or the

Department of Education for having allowed him to go to a classroom without seeing that he had a proper sense of the duties he had to perform there. For long years he had never thought of having a thermometer in his classroom; if it was hot they opened the windows wide, if it was cold they nearly shut them. The man at the other end of the hot-water pipes did the rest. For long years he had never suspected that there might be a physical basis for the various phenomena of the classroom, and that the things which he had regarded as stupidity or bad temper were largely due to his own neglect of physical symptoms and conditions. He had never fully realised that the condition of the mind must be as carefully controlled and watched as the condition of the body, and that it is possible to misdirect and overdo mental exercise, just as it is possible to misdirect and overdo physical exercise. He had never dreamed in those earlier days that it was part of his duty to send his boys out into the world with some adequate sense of the duties they owed to their own bodies. Surely the best way, though not the only way, of giving children true ideas of the laws of health was to see that those laws of health were properly carried out in their own schoolroom. He deeply regretted that he had left undone so many things that might so easily have been done, if only someone had come along and given him the hint. Now that he had come to his right mind, he would put the laws of health among the humanities, and would introduce children to the elements as soon as to the elements of reading, writing and arithmetic. Familiarity with those laws now seemed to him to be an essential part of the equipment of all teachers, but he himself found that it was not enough to feel like that. His long lack of experience would always tell. The subject could not be got up satisfactorily in after years when it had been neglected in the early days, and therefore he could not speak with such authority as he ought to speak, considering his long experience as a schoolmaster. All he could do was to offer himself to students at the outset of their career as a warning and an example.

Dr. Francis Warner (London) observed that he had just been attending a little girl who was in an exceedingly inert condition. He had been told the child was suffering from growing pains, but, as a matter of fact, she had developed rheumatism, heart disease had been allowed to grow up, and considerable damage had been done. Now some little knowledge of a special kind on the part of the teachers of that child would have prevented much mischief. He thought they were all perfectly well agreed that we want hygiene in our schools, and we want to be trained well in the knowledge and exercise of it. He thought that what is required is a hygiene teacher, but such an one must not hold an isolated position. Often the teachers of a special subject in schools did hold isolated positions, and the great necessity in their case was the forging of some common link between them all. One means to this end would be the study of children by all teachers by means of actual accurate observation. He believed that this would add a great deal to the healthy hygienic working of the school.

He hoped the work which was being inaugurated by that conference would be successful.

Dr. W. H. Willcox (London) said they had learnt the very great importance of hygiene as a subject for school teachers. When we realised that something like one-sixth of the total population was at the present time in our schools at the most receptive age, not only mentally but physically, we understood how extremely important it was that this hygienic teaching should be thoroughly undertaken both for the children and the teachers. The teachers were in a better position to carry out much of this work than the medical officers or the inspectors, for the teachers were continually present with the children. It is impossible for a medical officer in a large district to visit all the schools once a week or inspect say 60,000 to 100,000 children. It was quite impossible for a medical officer to have any detailed control over them. But the teachers could do very much, not only in giving attention to the ventilation of rooms and to matters of personal cleanliness, but also they could do so very much if they knew just the main symptoms of many common infectious diseases to which children are subject, and for which the parents did not call in medical advice. Unless the teachers recognised the early condition of those diseases they would be spread by schools and child mortality increased. With regard to the future of hygiene he would point out that hygiene is simply applied physiology. If our school teachers are to have a thorough grasp of hygiene—not the mere rule of thumb hygiene—they must grasp the principles so that they may apply them in actual working; if they are to have a thorough grasp of hygiene it is essential that they should be familiar with the principles of physiology. Of course they did not want the knowledge to be too scientific, to be too filled up with terms, but they wanted it to be as practical as possible and helpful in daily work. Doubtless one of the most important branches of hygiene for school teachers is that of practical physiology. He thought it was essential that the physiology which was learnt should be as practical as possible, and he advocated object lessons and the illustration of lectures by actual experiments, and so on. Although time was very much limited for students of school hygiene, he did urge them to learn physiology and to learn it as practically as possible.

Miss Hurlbatt (Principal of Bedford College) proposed a hearty vote of thanks to the Chairman and to the speakers, and said that Bedford College regarded the interest taken in this matter by Mr. Sadler as a very great encouragement to the work they were doing to the best of their ability in promoting the study of hygiene. Apparently the attitude towards the subject taken by the meeting was that it must be made a practical subject. She thought behind the practical knowledge there must be scientific knowledge, and that is a fact which the college must bear in mind. Their teaching could not be successful as popular teaching unless it was based upon theory and a scientific

knowledge. With regard to the teaching of hygiene in schools, they were anxious to have this most important subject understood and brought to bear upon the practical problems of life — domestic, public, civic, and national. Teachers must have an intelligent understanding of all the problems in regard to the care and development of the human body. They could not expect every teacher to have a profound and special knowledge, but they must have someone in the training colleges or large schools, someone behind the teacher with a really expert knowledge, and they must also have some college or some institution that would undertake to impart that knowledge. At Bedford College they were doing their best to supply students with a thorough scientific course in hygiene which should be preceded by a scientific education, and they also realised that teachers must be brought into contact with the meaning of hygiene problems, in order that they could supply some of the remedies that have been and are being pointed out by a thorough investigation of the subject.

The motion having been carried with acclamation,

The Chairman (M. E. Sadler), in acknowledgment, observed that the discussion had been practical, and added that all present were greatly indebted to the Bedford College and The Sanitary Institute for arranging the Conference. They greatly regretted the absence of Miss Ravenhill, because the valuable pioneer work which she had done on the subject in the North of England and elsewhere has been most fruitful. The discussion of this question emphasised three points: (1) The great importance of there being in the life of every teacher a course of preparation for his or her work, a period during which the gravity of health problems can be impressed upon his or her mind. Much good can be done by drawing the attention of teachers, during their course of training and afterwards, to the importance of practical hygiene in education, and to the practical steps which can be taken towards the better fulfilment of the laws of health. (2) The teaching of hygiene is of intellectual value, of economical value, and of moral value; and (3) there is taking place amongst all thinking people in this and other countries at the present time a change in our sense of educational values. We are realising that certain things are more important in education than other things to which we at one time attached greater weight.

THE REMOVAL AND ISOLATION OF INFECTIOUS PATIENTS IN POPULOUS DISTRICTS.

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(Fellow.)

Read at Provincial Sessional Meeting at Manchester, February 7th, 1903.

WHEN I somewhat rashly consented to open a discussion on this subject I was in hopes that that eternal enemy of medical officers of health—small-pox—would have left me some little leisure in which to put together something worthy of the occasion. But my hopes have met with disappointment; and when I apologise for the imperfections of my paper, I know that at any rate I shall have a full meed of sympathy from the brethren in the North. My highest hopes are that I shall perhaps afford you a few pegs on which to hang a discussion.

I. In the first place, though it is hardly possible now to say anything new about it, I should like to advert to Dr. C. K. Millard's recent writings on the hospital isolation of scarlet fever.

The indictment so ably put forward by Dr. Millard has been narrowed down, and now may be looked upon as an attack, not so much against hospital isolation *per se*, as against isolation hospital administration. It must be admitted by the keenest of Dr. Millard's opponents that he has opened the eyes of those responsible for hospital administration to many serious errors, and more particularly to the very untoward occurrence of return cases as diminishing the utility of hospital isolation.

Dr. Millard is to be congratulated on the courage with which he has, in Kipling's words, "walked by his wild lone in the wet wild woods" of

debate. He has worked his case up in a skilful, careful, and conscientious manner, and anyone who knows him personally as well as I have the pleasure of doing myself, can have absolutely no doubt as to the sterling earnestness and integrity of purpose which has pervaded every step of his action in bringing before the public health world the conclusions to which he was forced by his figures. By Dr. Millard's persistence the atmosphere has now been largely cleared of the foggy elements of dogma and surmise, and we can do little more until opportunity has been afforded for the collection of information on certain points, amongst which I think the following are the most important:—

(1) *The effect hospital isolation has in reducing the prevalence of scarlet fever.*—Dr. Niven has answered this question for Manchester after a most profound inquiry. His conclusions are as follows:—

> "(1) The isolation of cases of scarlet fever in hospital, as shown by a minute study of the facts of 1901, shows an actual reduction of the incidence of scarlet fever as the result of hospital isolation, not, however, so great as we could desire.
>
> (2) The chief influences working against the utility of the hospital as a preventive agent are the number of return cases and the number of overlooked and doubtful cases.
>
> (3) Had the hospital not been available, the number of cases would have, to all appearances, been much increased.
>
> (4) The statistics hitherto adduced to prove the inutility of isolation in hospital are quite unreliable, the sources of error being altogether too great.
>
> (5) It is probably that by adequate hospital administration, return cases may be sufficiently reduced to render them almost inoperative for harm."

It now remains for others to look into their records in a similar manner.

This inquiry is essentially one which cannot be fairly answered by statistics in the mass; where Dr. Millard and others have erred, in my opinion, is that they have in common language "lumped" statistics too much. What is wanted to answer this question is a collection in the first place of what one might term "family histories" of cases of scarlet fever, *i.e.*, a careful, thorough inquiry into the occurrence of scarlet fever in contacts, separating these into susceptible and non-susceptible. Such inquiries should include *inter alia* a note of the stage of the disease when infection was given off to these contacts, the *possibilities* of infection existing at the time in the premises (*e.g.*, character of house, ventilation, number of rooms,

intelligence of inmates, etc.), and if possible the probable dose of infection, and the health and power of resistance of the contacts. The evidence required to properly answer this question will be *most* difficult to obtain; some of the matters can scarcely be left to the unaided intelligence of the average sanitary inspector.

The idea that first found utterance in the days when the Book of Leviticus was written—"He is unclean: without the camp shall his habitation be"—has grown into the minds of all, experts and commoners alike, and has finally shaped itself into the erection of hospitals for the isolation of the infectious sick.

The utility of segregation to all concerned in such diseases as small-pox and typhus fever is not assailed by Dr. Millard or any one else that I know of, nor have any unwelcome by-products developed as the result of such isolation. Scarlet fever is a disease pretty much to itself, and one which unfortunately must be treated with a peculiar delicacy and care in the matter of isolation. But when that care is bestowed on the lines laid down by Dr. Niven and Dr. W. J. Simpson I think a definite assurance may be given that the benefits which have ensued upon isolation of other infective diseases will manifest themselves in connection with scarlet fever also.

(2) *The effect hospital isolation has on the occurrence of complications in scarlet fever.* There is one small point which in all this isolation controversy has not, so far as I have noticed at all events, been brought to the front, and that is that by means of the skilled nursing, proper feeding, etc., in isolation hospitals, patients have in innumerable instances been saved from complicating diseases such as those of the kidney (which would, I make no doubt, be found on inquiry to be more common in home-isolated than hospital-isolated cases), and which frequently leave behind them a crippled individual who at some future time becomes a charge on the community.

The extent to which complicating illnesses have occurred in home and hospital cases, and the degree of impairment they have left behind are things which most decidedly should be taken into cognisance in deciding as to the utility or otherwise of isolation hospitals.

(3) *The effect hospital isolation has on the mortality of scarlet fever.* The answer to this inquiry will doubtless be both hard to obtain and long in coming, for the influences of alteration in type and cyclical conditions are difficult to gauge.

(4) There are several other points, such as the indications of infectivity, the *quality* of infection carried out from hospitals and from homes, the

causation of infectious rhinorrhoea and otorrhoea, etc., which can only be settled by the bacteriologist; and if one is to accept the findings of Dr. Jaques, of the Chicago Health Department, the time will not be long before these questions will be answered. (Dr. Jaques claims to have confirmed the discovery by his colleague, Dr. Class, of the scarlet fever organism, and asserts that he can and has diagnosed the disease for the physician before the appearance of the eruption.)

In settling questions of the kind specified it is important that all investigations should be carried out on similar lines, so that a greater accumulation of comparable facts and figures may be ultimately available.

I beg to submit, therefore, that lines of inquiry and suggestions as to the mode of investigations should be drawn up by a sub-committee of The Sanitary Institute, and that these should be printed and sent out to all medical officers of health willing to carry out an investigation.

Most of us I take it are in agreement with Dr. Millard that overcrowding of wards and the promiscuous isolation of acute or septic and mild cases is productive of harm to the milder cases. I have seen cases of a mild nature come into a crowded ward, and in the course of a few days develop a "septic throat," with one or more of the usual sequelæ of that condition—adenitis, otorrhoea, rhinitis, etc. This is not a phenomenon limited to scarlet fever. Dr. Griffith of Hove has recorded a particularly clear case, in which certain patients with severe attacks of diphtheria (large bacilli present in throat) were brought into a ward containing a girl who had been there for twelve days with a mild attack; in a very short time this girl had a second bad throat with membrane, and the same large bacilli were obtained from her throat. ("Public Health," Vol. XV., p. 37.)

The fact has been noticed by other observers, *e.g.*, by Dr. Mahomed at the Islington Fever Hospital and Dr. Howse at Guy's Hospital (McNeill, Prevention of Epidemics, p. 151).

How far this condition of things is due to promiscuous aggregation of cases, and how far it is owing to permeation of the building with infective matter, is still an open question. Both factors of course can produce the same baneful result, but aggregation in my opinion is the more potent for mischief. The condition of aggregation admits of only one remedy, and that is the rigorous separation of acute from convalescent and severe from mild cases, and the liberal supply of air space. The other condition is one to which Sir Douglas Galton drew attention over thirty years ago, when he said in an address to the British Medical Association at Leeds:—"Buildings used for the reception of the sick become permeated with

organic impurities, and it is a real sanitary advantage that they should be pulled down and entirely rebuilt on a fresh site periodically." The remedy which Sir Douglas Galton recommends is rather too radical. I decidedly think however that wards should be thrown entirely out of use occasionally, and not merely subjected to a superficial cleaning, but that all plastered surfaces should be well scraped, sprayed with chloride of lime or other suitable disinfectant, and subsequently re-limewashed—the whole ward being allowed to "lie fallow" for two or three weeks.

I learn from Dr. F. Vacher the gratifying fact that the Local Government Board have officially sanctioned the inclusion in an isolation hospital scheme in the county of Cheshire (under the Isolation Hospitals Acts) of an auxiliary or convalescent hospital, the same to be situated at some distance from the infectious hospital proper. The Board have stated that County Councils may properly contribute a proportion of the cost of such auxiliary or convalescent hospitals. This opens up a delightful prospect of abolishing return cases by giving convalescents a few weeks of moorland or seaside residence.

II. I have been much struck in going through the Report of the Metropolitan Asylums Board for 1900 and 1901 with the number of recorded errors in diagnosis in cases sent for isolation in the Board's hospitals. Take the following figures for example:—

	SMALL-POX.		FEVER.	
	Mistaken Cases.	Per Cent. of Notification.	Mistaken Cases.	Per Cent. of Notification.
1900	30	13·3	1706	7·8
1901	245	32·0	2365	9·2

Percentages of Error in different Diseases.

	1900.	*1901.*
Scarlet Fever	5·5	5·6
Diphtheria	8·3	12·8
Enteric Fever	18·2	25·5

These figures are undoubtedly far too high. Note those for small-pox in 1901, when the errors were about one-third of the reported cases, and in enteric fever in 1901, when they were one-quarter of the total cases certified for admission. In some of the hospitals the errors reached higher figures than those named, *e.g.*:

38 °/₀ of cases certified as enteric fever and admitted to Western Hosp.
29·2 °/₀ „ „ „ Eastern „
16·6 °/₀ „ diphtheria „ Grove „
27·2 °/₀ „ „ „ North-Eastern „

In the Metropolis the diagnosis is controlled in the case of small-pox at wharves, and in case of other diseases in admission wards of hospitals. Many of us in the provinces have not these admission wards, and in these cases the question arises, should the Medical Officer of Health or Medical Superintendent of a hospital be called upon to pass an opinion on a case before its removal to hospital? In cases of small-pox the general practitioner is usually ready to avail himself of any assistance the Medical Officer of Health may feel competent to give, and probably no Medical Officer of Health would deem it outside his duties to see such cases in consultation.

His experience of cases of infectious disease is almost bound in those days of hospital isolation to be larger and more intimate than that of the general practitioner, and the benefit of that experience should be freely given to all professional brethren.

In the case of other diseases the question is not so easily decided. In diphtheria and enteric fever it is probably not so pressing: infection in those diseases is more limited in its liability to spread from patient to patient. But in cases of scarlet fever the difficulty is an acute one: a case of doubtful scarlet fever may prove to be anything from "nothing at all" to readily communicable diseases, such as measles, german measles, diphtheria, influenza, etc.

The only proper solution of course is the provision of an observation or admission (reception) ward. Failing this the wise medical officer of health will unreservedly place his services as a consultant at the disposal of all the medical practitioners in his district, and his responsibility then ceases at once.

I cannot hold with those who deem it the prerogative of the medical officer of health to visit at their homes cases certified for removal to hospital, in spite of the argument that such a proceeding might in many cases avoid the expense, trouble, and annoyance of unnecessary removal, disinfection, etc.

Neither can I quite join issue with those (like Dr. Newsholme) who desire the notification of *suspected* cases, for though in some of those the result may haply be the securing of supervision at an earlier stage in cases where the suspicion is confirmed, yet the system has several drawbacks:—(1) It would impose a somewhat unfair burden on the resources of a Health Department—a burden which is at present heavy enough in those cases which are unofficially brought to the knowledge of the medical officer of health by practitioners—and which would undoubtedly grow to serious proportions if the thing were legalised and made compulsory.

(Imagine the work of a medical officer of health when an outbreak of influenza coincided with one of small-pox.) (2) It would be liable to lead to the imposition of many restrictions and hardships on the side of the patient and his relatives, which would be strongly resented, and would often reflect adversely on the practitioner responsible for the notification: and (3) considerable and awkward modifications of the law relating to infectious disease would be required.

As a means of ensuring greater precision in diagnosis I am of opinion that the course of instruction in infectious diseases given to medical students should be much more extensive than it is at present. Is it not almost a scandal that a training of only a few weeks duration should be given in that branch of professional knowledge on the possession of which in an adequate degree the safety of large populations frequently hangs?

Our President of to-day, Dr. Wynter Blyth, has suggested that by the circulation of coloured diagrams, illustrating the various exanthemata in their different stages, the education of the qualified medical man in these matters should be furthered. But would it not be much more preferable to have a sound foundation laid at an earlier stage in our education? I recall with amusement my own education in this particular subject at Edinburgh eleven years ago. Then attendance for clinical instruction at the fever hospital was optional for the university degree, and although I believe I paid some three visits myself of about half-an-hour's duration each, I knew a large number of men who found other more alluring modes of passing time. The difficulty could be made to vanish at a touch by the General Medical Council, and I submit it is quite time for a more adequate system of practical training in this subject to be rendered obligatory on all medical students.

III. A number of debatable points arise out of the consideration of the question—*For how long should cases of scarlet fever, diphtheria, and small-pox be detained in hospital?*

The desquamating cuticle in scarlet fever is shorn of most of its terrors by the researches of Drs. Klein and Mervyn Gordon, as well as by the experience which most of us have had of hospital cases discharged with abundance of loose epithelium about them. I recall a case in which I found a girl in a public elementary school desquamating freely after scarlet fever, and picking bits of skin off her hands to pass to her friends on the same bench, the friends in several instances putting the bits of skin into their mouths and biting them. Despite the unlovely and appalling nature of this incident it was curiously enough not followed by a single case of scarlet fever in the other girls!

But if one is to accept the "Class" micrococcus as the causal organism in scarlet fever one must modify the statement that the desquamated cuticle is *per se* non-infectious, and detain desquamating cases in hospital accordingly.

Personally I do not attach any very great importance to an examination of the throat and nose before discharge of scarlet fever cases. Such an examination should certainly be made in all cases. The actual presence of a discharge from the nasal or pharyngeal mucous membrane, of course, means further detention in hospital. But I believe (from an experience of several thousand cases) it will only be in rare instances that any condition will be found of assistance in deciding whether the patient may be safely discharged or not. Here we must patiently await the decision of the bacteriologist.

In the case of diphtheria the presence or absence of the B. diphtheriae is the one thing which should determine discharge from or further detention in hospital. That this is not a mere counsel of perfection is shown by the fact that in many provincial hospitals this practice is carried out. I do it myself in the few diphtheria cases I get for isolation, and I am happy to say that a good many medical men in Stockport observe the same precaution in cases isolated at home.

In view of the analogy between this disease and scarlet fever I am strongly of opinion that diphtheria cases should be transferred to a convalescent ward for a couple of weeks or so before discharge, so that the elimination of the offending bacillus may be facilitated.

In the case of small-pox it used to be taught that all scabs must have fallen and the skin, particularly that of the palms and soles, be *perfectly smooth* before discharge. I cannot entirely subscribe to this teaching. When the pock has been removed from these parts of the body and a reasonable margin of skin all round it has been cleared, I discharge my patients, no matter how rough and uneven the rest of the skin may look. If one is to wait until the skin of the hands and feet is as smooth as a sheet of notepaper, then many of our patients would have to be isolated for several months. At any rate, though the majority of my discharged cases have gone back into susceptible populations in lodging houses, etc., no "return" cases have as yet appeared. On this point I should be glad of an expression of opinion from the meeting.

IV. Dr. John Robertson in a paper written in 1893 threw out the suggestion that all infectious diseases should not be dealt with by means of the same legislative measures. At present the same statutory obligations are applicable to diseases so widely divergent in their natural history and

modes of propagation as typhus fever or small-pox and typhoid fever, relapsing fever, or even puerperal fever. No remedy is suggested by Dr. Robertson, but the one which naturally offers itself is that the various dangerous infectious disorders should be separately classified, or scheduled in groups, and legislation amended so as to bring our legal powers for limiting the spread of groups similar in etiology into line with the most recent established theories. For example, taking the notifiable infectious diseases, small-pox, typhus fever, and scarlet fever, might reasonably be included in one class; diphtheria or membranous croup, typhoid and continued fever in another; and relapsing fever with erysipelas and puerperal fever in a third. The most stringent preventive measures would naturally be imposed in respect of the first group, and might reasonably be extended in great part to all persons who could be shewn to have been in contact with the actual sufferer; it would probably suffice if the sufferer himself and his immediate attendants were placed under restriction in the second and third groups.

It may be argued, on the contrary, that no good would be effected if the medical officer of health were shorn of power in dealing with cases of those infective diseases which are infective in a lesser degree. It is discretionary now with him whether he shall enforce all the restrictions specified by law and that discretion is best left undisturbed. With this latter view I confess to a considerable degree of sympathy.

Rather let us put up with the laws we have than fly to others that we know not of.

It is a question, however, whether local by-laws could not be framed (if power were given to frame them) by which home isolation could be made more perfect in detail. This is a matter which has been impressed upon me since I came to know more about the conditions under which, for example, *outworkers* labour. The real dangers to the public in cases of infectious disease are two—the unrecognised case and the careless patient or person in charge, and of the two I firmly believe that the latter is the greater, the greatest danger of all being, of course, when the two are combined. The former cannot reasonably be brought under legislation but the latter can, and I would bind him down with the severest and most detailed restriction.

V. In this same connection there seems to be a doubt in the minds of some health officers as to whether one can compel any precautionary measures to be taken in the case of those persons who have been in contact with cases of dangerous infectious disease. Whilst this is not named in legislation as a specific offence, it is my own custom to deal

with it under Section 126 (3) of the Public Health Acts 1875,—"exposes without previous disinfection any bedding, clothing, rags, or other things which have been exposed to infection from any dangerous infectious disorder." It would be interesting to have a case bearing upon this point legally tested.

VI. The Local Government Board have recently declared officially that money spent in quarantining contacts is a legal expenditure in the case of small-pox under certain circumstances as, *e.g.*, "where laundries are in question, or where the business or habits of the inmates of an invaded house are such as to make it difficult for proper medical observation of them to be maintained."

The expense which would be involved in applying similar measures in the repression of scarlet fever or diphtheria, etc., rules it out of court at present, though there can be little question that it would be the ideal course to adopt.

One is pleased to note that the Local Government Board have virtually condemned as unnecessary the quarantining of small-pox contacts "in districts where sanitary matters are properly administered, and vaccination and re-vaccination efficiently carried out." In an epidemic of small-pox with which I had to deal in 1892–3 in the West Riding of Yorks, I advised certain sanitary authorities there that such a system was in effect a waste of public money. I have never had any reason as yet to alter that opinion, and I am naturally glad to be able now to quote an official utterance on the point.

In the case of all infectious diseases where the patient is removed to hospital, I think a mistake is too commonly made of not keeping the contacts under observation until the incubation period *plus* a reasonable margin has expired. Not only should this be done, but in the case of scarlet fever and diphtheria more particularly, known contacts should be similarly kept under observation after the return of the sufferer from hospital. The influence of hospital isolation in diminishing the prevalence of infectious disease in any town taken as a whole, is lessened by the occurrence of unrecognised or doubtful cases. No measure that could be practically adopted will ever discover all such cases, but in omitting to carry out observation of contacts we are, I think, neglecting the first line of defence.

VII. *Measles Isolation.*—Inasmuch as the mortality from this disease is largely increased by insanitary surroundings, a plea may well be put forward for the hospital isolation of such cases as are in unwholesome surroundings at home. Further than this none but the very venturesome

dare go at present. The need for hospital isolation is greater, of course, in those large centres of population in which many people of poor means and poor education live, or where a large proportion of the population live in tenement dwellings, as in London, Edinburgh, and Dublin. I have no experience of the hospital isolation of measles, but my old teacher, Sir Henry Littlejohn, has been good enough to send me his opinion on the matter after a trial of twenty years, and I am sure this will be valued by you:—

"Although we have treated this disease in our infectious hospital during the last twenty years, yet such isolation has embraced only a very small proportion of the total cases.

With epidemics of measles numbering thousands of cases, it has naturally only been possible to isolate those of special urgency—as, for example, those occurring in a dairy, common lodging-house, school, or boarding establishment.

Where, too, as in the case of the very poor, the accommodation or surroundings are specially bad, or where the complications of the disease are serious and cannot be properly treated, we always stretch a point and admit to our hospital.

So far as our experience goes here I cannot otherwise give any opinion as to the benefits of isolation; although, of course, theoretically I believe very strongly that isolation *of all cases* at the beginning of an epidemic would be of the greatest benefit."

VIII. *Whooping-Cough.*—Much in the same category as measles comes its companion whooping-cough, and the remarks made concerning measles apply I think with equal force and yet equal restriction.

Dr. A. K. Chalmers has kindly given me his experience of the hospital isolation of this disease. Of 1,735 cases occurring in 1901, 308 were isolated in hospital; of deaths from the disease 850 occurred in home cases and 72 in hospital cases. But it would be unfair to draw any conclusions from these figures as to the utility of hospital isolation in preventing a fatal issue, for one does not know exactly what principles guided the selection of cases for hospital isolation.

I am somewhat hopeful that in both measles and whooping-cough the work of female inspectors will do as much as anything towards limiting their spread and lessening their fatality.

I quote Dr. Chalmers' own words on the subject:—"With the exception of notification, all the measures practised here in the major infectious diseases are applicable to whooping-cough, so that exclusions from school, both of the sick child and other members of the family, disinfection, etc.,

are all put into operation, although as the volume of the disease present at one time is never wholly known, the operation of these measures must reach a relatively smaller proportion than is the case in the notifiable diseases. It would be difficult to allocate the relative values of isolation, disinfection, and control as above indicated in reducing the mortality which has occurred in past years, but comparing the death-rate during the years 1855–64 with that of 1891–1900, I find that it has fallen from 1647 to 879 per 100,000. While, therefore, as practised here, removal to hospital has primarily the treatment of the child in view, it is not at all unlikely that there is an educative value in this which raises the importance of whooping-cough in the eyes of the community, and may here and there stimulate them to active participation in repressive measures in individual cases."

IX. It has been borne in upon me, not only in Stockport but in other towns, that the indiscriminate and wholesale removal to hospital of scarlet fever cases is a course of action not without considerable drawbacks. One of these drawbacks is that it weakens that sense of individual responsibility which is at the root of good citizenship. It has been openly said to me by the mother of a family that she did not think much of scarlet fever, because when children got that disease they were taken to the hospital, and they were "well done to" there. Another mother, who was in the unfortunate position of having three young children simultaneously attacked with measles, confessed that she would much rather it had been scarlet fever, "because they took them to the hospital for that and there was then no bother with them." Indirectly, therefore, I am convinced that in many cases wholesale isolation is the cause of relaxation of proper precautions on the part of parents and others having the charge of children. The remedy for this wretched apathy lies, to my mind, in imposing a small charge, proportioned to the means of the parent in each case, for isolation in hospital. The charge need only be a nominal one of a shilling or two per week. It is one which local authorities are authorised to make (Public Health Act, 1875, sec. 132), and it is a charge which is now made by a fair number of local authorities. The imposition of a small and legally authorised charge would not invalidate any powers for compulsory removal in cases where that was necessary. It may safely, I think, be prophesied that such a step, if adopted, would have the effect of stimulating individual responsibility, and by so doing would contribute to the protection of the public health.

X. I cannot close without a brief reference to what is, for some vague and unfounded reason, termed the "Leicester system" of dealing with

small-pox. What there is about it peculiar to Leicester, except the absence of the enforcement of vaccination, is a thing I have never heard satisfactorily explained. The payment of compensation to contacts kept from work is claimed by Leicester as original, but in reality it is a measure which has been adopted for many long years by numerous local authorities, and although Leicester has special power under a local Act of recent date (1897) to do this, that power is really unnecessary in view of the general practice of the Local Government Board to sanction the spending of money for that purpose, a practice which has been known to myself—a comparative youngster in the service—for about twelve years.

It is said that "a handful of the population, including the medical men, sanitary staff, small-pox nurses, etc., are as well vaccinated in Leicester as in any other town, so that *a cordon of protected persons can at once be drawn round any case of small-pox which may occur.*"—[Dr. Millard's Annual Report, 1901, page 19. The italics are my own.]

I am sure my friend Dr. Millard will pardon my saying that if that statement were not so lamentable it would be ludicrous. A couple of cases of quite recent occurrence in Stockport will best show how utterly unpractical and impotent such a statement is in its application. (1) A tramp living at a common lodging house with about 60 other lodgers took small-pox, and the disease was recognised by the keeper; instead of putting the man into a room by himself and sending for me the keeper gave him my address and the address of one of my special inspectors and told him to go to one of us at once. The man set off but instead of coming to us he went tramping about over nearly the whole of the town for three days, sleeping in out-houses, begging at doors, and going in and out of shops and public-houses, finally presenting himself at another common lodging house and being sent from there to my own house where he arrived at 10.30 o'clock one night, having had, as he termed it, "a job to find it," and having had to inquire his way of a good many people. He was in the pustular stage of a bad discrete attack when he arrived at my house. Since his departure from the common lodging house where he first stayed there have been five cases removed to the small-pox hospital in spite of disinfection, strict surveillance of contacts, etc., and it is only after the free use of revaccination that we have now extinguished the outburst in that centre.

(2) A case of small-pox occurred recently in a person employed at a large works employing some 300 hands in Stockport. Inquiries failed to discover the origin of the case, and it was not clear until some sixteen or eighteen days afterwards, when I had a note from the medical officer of

health of a neighbouring district, saying he had just discovered that four weeks previously a boy employed at these works and living in his district had been suffering from a mild attack of small-pox, and had only been absent from work during the first three days when the premonitory symptoms were on. His attack had been so mild that it was not discovered until two other severe cases occurred in his own family. This boy had been travelling to and from his work by train daily for about four weeks whilst in an infectious condition.

I ask how, in the name of all that is practical, could "a cordon of protected persons be at once drawn round" cases of this description except by recent vaccination of the entire population with which the cases come in contact?

If I were given my choice of all the preventive measures known to science for the repression of small-pox, and were asked to choose one and one only, I would unhesitatingly throw to the winds notification, isolation, disinfection, quarantine, "Leicester" system, or any other system, etc., and pin my faith wholly and solely to universal vaccination, and I know that not one medical officer in ten thousand would do otherwise.

More than that, I am confident that Dr. Millard would unquestionably make just the same choice.

Stronger words than those I cannot use: if I could I would.

Dr. Garstang (Medical Officer of Health, Altrincham) said perhaps he might be allowed, on behalf of the members of The Sanitary Institute in the provinces, to thank the Council for instituting this arrangement of provincial meetings, and to say he hoped the present meeting would be regarded as being sufficiently satisfactory to encourage them to continue the series. He would like, on behalf of that meeting, to thank Dr. Meredith Young for the extremely valuable paper he had partially read to them. He was afraid he was rather out of court, because he did not know anything about the conditions in populous districts. His experience was entirely rural, but there were one or two matters in the course of the paper which he (Dr. Garstang) had noted, and he did not hesitate to give the audience his opinion on those points. He confessed to his position and lack of experience, and so they must take what he said for what it might be worth. First of all, in regard to the effect of hospital isolation on the prevalence of scarlet fever, he should have no hesitation in asserting, within his own experience —if he had correctly interpreted the facts which had come before him– that he was satisfied hospital isolation did in country districts reduce the prevalence of scarlet fever. He had seen many instances where prompt removal had arrested the prevalence altogether, either in a particular house, or a group of cottages, or

in small villages. As to the effect of isolation on the occurrence of complications, he was of opinion, and he dared to say many of those present would be, that hospital treatment—by which he referred more to the nursing than to the medical treatment, of course—was infinitely preferable for any individual patient to the casual home-treatment in houses of the working classes. And therefore he did not hesitate to give his support to the belief that hospital isolation did diminish the occurrence of complications. That being so, it follows almost logically that hospital isolation will also have a favourable effect on the mortality. That he believed he had himself observed, but they were matters of course open to discussion if members of the meeting took other views. And, after all, having given one's personal opinion, he did not know that they could enter into detailed arguments in support of it. Dr. Young referred to the prerogative of the medical officer of health to visit at their own homes cases which have been certified for removal to hospital. This is where the difference comes in between the medical officer of health in a country district and one in a large town. In his (Dr. Garstang's) district nobody certified for removal to the hospital except himself. They had not the hospital accommodation to allow everybody to send cases promiscuously. Simply because it was a physical impossibility to do any such thing, he never dreamt of visiting cases at their homes. That was a question which, like many others, had entirely different aspects in the case of a big town and a country district. He did not presume to say what should be done in towns. He was rather surprised that Dr. Young did not attach much importance to the examination of the throat and nose, and that was the only point upon which he was not in accord with him. He certainly had thought that many medical officers of health, and especially medical men in charge of infectious hospitals, did attach at the present time considerable importance to the examination of the throat and nose before discharging cases. He had had very little experience indeed of return cases, but he had had within the last few years two distinct instances of return cases of scarlet fever, where he was perfectly satisfied that the cause and effect had been genuinely connected, and in both those cases the mischief appeared to be discharge of the ear and nose, which was not present when the child was discharged from the hospital, but developed within a week or ten days after it arrived home. He could only offer that as a simple statement of facts. There was only one other question he wished to allude to now—the question of dealing with "contacts." That was a large question, which no doubt had received the consideration of many medical officers of health. It was the one point which had been his greatest difficulty. Medical officers had certain powers over patients suffering from infectious disease, and they had certain powers over the parents or guardians in the case of children, the persons responsible for the sick people. But as far as he knew there was no provision in the law whatever for dealing with what he called "third parties," other members of the family, neighbours, friends, or visitors, who might have been in close contact, and were at perfect liberty to

walk out of the house into anybody else's house and carry as much infection as they could. He had never discovered any means of dealing with those. He had put the question to the clerk of one of his authorities, a barrister-at-law: "Can we possibly deal with these cases under section 126, sub-section 3, of the Public Health Act, which deals with the exposure without previous disinfection of bedding, clothing, rags, and other things?" and said that these people were exposing infected clothing. He laughed, and said, "I see your point. It is ingenious, but in my opinion you would never get a bench of magistrates to convict. They would consider that you were stretching the words of the statute far beyond what the legislature intended them to mean."

Dr. E. Sergeant (Medical Officer of the Lancashire County Council) said he quite agreed with the remarks of Dr. Garstang respecting the importance of this paper. He also agreed with Dr. Young's conclusion with respect to the isolation of scarlet fever. As Medical Officer of Health of the county of Lancaster he had formed a very favourable opinion respecting the advantage of hospital isolation of scarlet fever, and had satisfied his own mind that hospital isolation formed an essential part, a sine quâ non, of sanitary administration. He considered also that the effect of hospital treatment was of very great importance to the community. He had at that time to deal with a large number of reports from various districts within the administrative County of Lancaster representing a population of one and three-quarter millions, and from those reports he had had the opportunity of observing the beneficial effects of hospital treatment on scarlet fever versus home treatment; generally there was a less case mortality, varying from 25 to 50 per cent. in some instances. He thought that fact in itself was sufficient to show the necessity of having isolation hospitals treating infectious diseases. It was very important that local authorities should have hospitals of the best character. He thought it was generally recognised that hospitals should be built so that the patients could have the most efficient treatment, and that the nursing and other provisions should be such that the patient's life would not be jeopardised by removal. Some time ago it used to be suggested that a hospital could be built for £200 a bed, but he thought now it was recognised—in this county, at any rate—that hospitals, say with provision for the treatment of 30 patients, cannot be built under £350 to £400 per bed, irrespective of land. He thought his estimate was reasonable, for in some cases, as was known, a good deal more was spent. The recently erected hospital at Baguley, for instance, cost £600 for each of its 100 beds, but it must be remembered that the accommodation provided was exceptionally good, and in every respect up-to-date. He wished to refer to the admission of patients. As the local authority became responsible for the treatment and well-being of patients admitted into an isolation hospital, it seemed to him desirable, in order to avoid the possibility of an error in diagnosis and the resulting difficulties, that a careful examination should be made by the medical superintendent of the

hospital of all cases previous to admission. There ought to be no risk of a person being wrongly admitted into an infected ward and having his life placed in jeopardy. He therefore urged that the authority should have medical supervision of the cases admitted the same as they had in respect to cases discharged. There was only one other point he wished to deal with, and that was with respect to small-pox. He did not know that it really came within the paper, but incidentally the effect of tramps had been mentioned. In his opinion the epidemic of small-pox at the present time was spread chiefly by vagrants going about the country suffering from the disease; this was in accordance with the experiences he had had in previous years, more especially in 1893. At that time it was brought before the Society of Medical Officers in London, resolutions were passed on the subject, and he thought it was decided that a deputation should go to the Local Government Board with respect to some restriction being imposed on the vagrant class, especially when small-pox was prevalent. Nothing had resulted. These tramps, these parasites that are a nuisance to society, are still allowed to spread disease, and they do spread it. He thought if they were allowed to go about with freedom they certainly should be required not to be a danger to the public, and it seemed very little to ask tha they should be efficiently protected by vaccination. Medical officers ought to have power to vaccinate them and provide against their being a danger to the public. If they would not submit he would suggest that they be incarcerated until they attained a proper mind on the subject.

DR. FRANCIS VACHER (Medical Officer of Health to the Cheshire County Council) said he would like to begin by adding his word to what had been said already as to the excellent paper with which they had been favoured that morning. It was the paper of a man with a great deal of experience, a level-headed man who was able to discern what was before him, and able to draw just deductions and come to just conclusions from the facts presented to his intelligence. The matter referred to in the earlier part of the paper was the question which had been started many years ago by Dr. Millard as to the utility or inutility of isolating cases of scarlet fever. Dr. Young had very properly pointed out that, the grave defects in the system at present adopted of isolating scarlet fever was that occasionally patients who were admitted for comparatively slight attacks might themselves be infected by cases coming into the ward with very severe forms of the disease. The result was that a patient who came into hospital to be cured of a mild attack got complication which he certainly would not have got if he had remained at home. This should teach us not to have large wards for scarlet fever. They were all of them that afternoon to visit the beautiful hospital at Ladywell, which was an institution in which the scarlatina wards were a little too big. In most places it was sufficient for a scarlatina ward to hold from eight to twelve beds, and larger wards would be likely to lead to a condition of things which was so prejudicial to those who had the disease in a

light form. As regards another matter referred to in Dr. Young's paper, so-called "return cases," the solution of that part of the problem was he believed the establishment throughout the country of convalescent hospitals by infectious hospital authorities. A hospital was being enlarged in his county, and he had been requested to meet the Board; as return cases had from time to time occurred, the Board had thought of having a convalescent hospital and they had asked him if the County Council would give the usual contribution towards the site and erection of that auxiliary hospital; he had said so far as he was concerned he should be in favour of that being done, and he believed that the County Council would give the same proportion towards the cost as they would to an ordinary infectious disease hospital. He said the proper course would be to send a letter to the Clerk of the County Council stating the case so as to give them an opportunity of putting the case to the Local Government Board. That had been done and they had received a most clearly expressed letter stating that all power which various authorities possessed for the erection of infectious disease hospitals and for contributions towards them obtained just the same with reference to auxiliary hospitals as to other hospitals. So much for that. But the question introduced another, and that was whether it would be well to have two for scarlet fever, one for light cases and one for the more malignant cases, making provision for two kinds of scarlet fever would not be easy, inasmuch as they had already found it so exceedingly difficult to provide for three diseases other than small-pox. Most hospitals indeed provide for two infectious diseases only, those were ordinarily scarlatina and typhoid fever. In a few instances a pavilion had been provided for diphtheria cases. Then if Dr. Duke's view was correct that there was a so-called fourth disease which was not scarlatina but something like it, that would make a fifth disease to provide for. All that makes the question of provision more and more difficult. And it was quite possible if they pressed this matter too much that the ratepayers who had hitherto supported them fairly well would support them no longer, and there might come a reaction against making provision. This introduced another subject and that was the question of cost. Twenty years ago it was quite usual in giving an estimate for the provision of an isolation hospital to put it down at £100, £120 or £140 per bed, and there were lots of hospitals which had been built giving provision for twenty patients at £140 a bed. An estimate of £140 was counted at that time quite sufficient by the Local Government Board. Now an estimate for providing a hospital for £350 a bed was sometimes regarded as insufficient. This showed the change of opinion that has taken place. However it was just possible to spend too much on a hospital. For example the new hospital at Baguley, providing 100 beds, had cost £600 a bed. Spending so much did not encourage neighbouring authorities to provide isolation hospitals. With regard to the subject of tramps. Most of us have had some experience of the way in which tramps spread disease, and several suggestions had been made as to how their movements could be controlled. It had occurred to him that as

many tramps were hawkers and thus compelled to be formally licensed by the magistrates and carry their licenses about with them all tramps might be treated in the same way, and not allowed to go from place to place in search of work or otherwise unless furnished with a permit. A man who was a hawker would go to a magistrate and be charged 5s. for a license, and he (Dr. Vacher) thought it would be reasonable to require a license or permit, to be carried by all tramps. They could then report themselves from place to place, and they could be charged for the permit a very small sum or nothing at all.

Dr. J. B. Wilkinson (Medical Officer of Health for Oldham) said that he thought the first duty he had to perform was to tender his sincere thanks to Dr. Young for the pleasure he had given them that morning in reading such an able paper. His only objection to it was that it did not reach him until the morning's post, and so did not give him time to look through it before he came to the meeting. He often wondered how Dr. Young was able to find the time to write such papers, and to do the amount of work he does; he must have the facility of working twenty-four hours a day, or else of turning twelve hours into twenty-four. It seemed to him the discussion so far that morning had been almost entirely on one disease only, namely, scarlet fever. The heading of the paper was: "The removal and isolation of infective patients." Some slight mention had been made of small-pox and other diseases, but perhaps the reason of that was that it was only with regard to the removal of scarlet fever that any great objection had been raised. With regard to the removal of small-pox he did not think anyone had ever yet raised anything more than a mere trivial objection, and that had generally proceeded from the patient himself, who was apt to look at his removal to a hospital from rather a selfish point of view. All cases of small-pox, he thought everyone present would agree with him, should certainly be isolated in hospital, except in very special cases, such as an isolated house, where the case was only a very trivial one and the patient could be thoroughly isolated. With regard to another disease which had been practically stamped out at the present time, he thought there was also no possible objection to the removal of affected cases to hospital, viz., typhus fever. Very few of them as medical men had any knowledge of typhus, because the disease has been practically stamped out. But in the dwellings in which he had experienced it, it would have been impossible to treat the disease without its almost certainly spreading from one room to another, or from one dwelling to another, situated as they were on a common stair. The best possible thing under these circumstances for the patients themselves, was to remove them into well-lighted and well-ventilated wards. Another disease which they usually remove in the present day is that of typhoid. In a large proportion of cases there was not the same reason for the removal of this disease as there was in the case of more infectious diseases. But speaking of the working classes, there was usually no facility for isolating the patient; no adequate supply of trained nurses to attend

to them, and the latter was, perhaps, the more urgent reason for the removal of these cases. In the ordinary working-class house the nursing has to be done by an untrained person, who has no idea of what the typhoid bacillus is, or of the manner in which typhoid spreads. The ultimate recovery of the patients in these circumstances is very considerably influenced by the removal of such cases to a hospital where they are nursed by properly trained nurses, who understand how to deal with the disease. There was only one objection that he had to raise to the removal of typhoid patients to hospital, and that was where patients suffering from typhoid rather severely had had to be removed a considerable distance, the effect of their removal had not been altogether satisfactory. The patients had arrived at the hospital, he would hardly say collapsed, but certainly tired out, and it had taken them, very often, two or three days before they recovered from this exhaustion. He had found that to be the case however carefully they might have been removed. There was another objection that he was going to say used to be made: the errors of diagnosis. If the chairman would allow him to say what had occurred to him during the reading of Dr. Meredith Young's paper, he must say the Metropolitan districts are very considerably behind the Northern districts if they have such numerous errors in the diagnosis of typhoid fever with the almost accurate diagnosis which can be obtained by Vidal's system, which reduces the errors of diagnosis almost to vanishing point. If there is any immediate necessity the diagnosis by this method can be obtained very quickly, within a few hours indeed, and delay of removal in the case of a typhoid patient cannot be of very serious consequence. With regard to milder diseases, such as measles and whooping cough, he thought the isolation of such diseases at present hardly came within the range of practical administration. The hospitals they would require for treating cases of measles, where any attempt at removal on an extensive scale was practised, would be on such an enormous scale that the price and cost of maintaining them, even at a time of no epidemic, would be very serious indeed. And lastly, he came to the two diseases, in respect to the removal of which there had been some criticism—very strong criticism, and very honest criticism—from Dr. Millard, viz., scarlet fever and, to a less extent, diphtheria. With regard to diphtheria, his own opinion was that the removal, except in exceptional cases, was not advisable unless the patient was taken to a hospital where there is a resident surgeon. His experience of removing cases to a hospital where there was no resident surgeon was not altogether satisfactory, especially in the milder cases. With regard to scarlet fever, he thought Dr. Garstang had mentioned that he had not had very much experience of large towns, being more connected with rural districts. He had had some slight connection himself with a rural district, and he thought they could see very often the effect of the removal of patients from those districts, because they found they could trace the disease better than they can in a large town. The cases could often be traced from one house to another, where the patient had not been removed; but in cases where the

patient had been at once removed to hospital there had been no further spread of the disease. It was not possible to do that in the larger towns, because, in the case of most medical officers, scarlet fever was always with them more or less. The principal objection to removal may perhaps be the question of return cases. He had had one or two experiences, rather bearing on the question of return cases, in his own district during the past year or two; and these had brought him more than ever to the belief that a large majority of return cases were not due to the patients leaving the hospital at all, but to some faulty condition in the houses to which they return. He had had a remarkable experience a few months ago: A person well-educated, living in a good house in the town and thoroughly intelligent, had a child ill with croup, as was believed, before the disease was diagnosed as scarlet fever. A bran-bag was used to apply to the swollen throat which had been kept in the house and used over and over again whenever such an appliance was required. It was heated and applied to the child's throat, and then, without thinking, the mother put it away in a drawer without having it disinfected. The child was isolated at home and the house was disinfected on recovery. About a month after disinfection a second case of scarlet fever occurred. On enquiry it was found that this bran-bag had been brought out again and used for the second child, and about three or four days after use this child developed scarlet fever. If cases of this kind occur in well-to-do houses, what must one expect to find in the average working-class house, where they understand very little about infection and were very often careless. He had also had two other remarkable instances of return cases at his own hospital. In each of these cases the child was sent to the hospital, but in only one was there any serious disturbance at all. This child had a very slight sore nose, but no ear discharge, and with that exception the fever ran an ordinary but mild course. The child was in hospital six weeks. Five or six days after this child returned home the second case came in, and this was very naturally considered a return case. This child had not the slightest bad symptom, and was discharged perfectly well at the average time. Nine or ten days after there was a third case from the same house. In another family exactly the same thing occurred, except that in the first case there was no ulceration of the nose or other bad symptom. The fact of such occurrence in two houses led one strongly to suspect that there was some infection left in the houses, and not in the patients themselves. The question of Sunday clothes not being disinfected had been mentioned, and it was possible and very probable that people did not care to, and will not have their clothing all disinfected. They hide it and lock it up while the house is disinfected, with the result that when the patient comes out of the hospital the clothing reappears, and in this manner we get the so-called "return cases" coming back to the hospital. There were one or two other points he wished to refer to in the paper; one was in reference to cleansing the wards of a hospital. His own experience was that when infectious hospital wards have been used for some considerable time, the patients did not do so well, and septic throats, etc.,

occur. To remedy this he had taken the precaution of having, at regular intervals, the hospital wards cleared entirely, disinfected and thoroughly cleansed before being occupied again; and he had found on several occasions that this had had a very marked and very beneficial effect. One word with regard to small-pox, and that was the question of drawing a cordon round the patient, mentioned by Dr. Young, and when he read these remarks in the report of the Medical Officer of Health for Leicester he was wondering how he did it, because his experience of small-pox recently had been that one would have practically to draw a cordon round every person going about the town. Dr. Young, unfortunately, had had an experience which goes to show the difficulty there is in relation to this. It was the case of a girl from his town who had not any idea that she was suffering from small-pox or any sort of infectious disease, and who went to visit a relative in Dr. Young's district. A fortnight after the girl's visit two cases of small-pox occurred. The girl lived in a district where there had never been a case of small-pox during the whole year.

Mr. Sharpe (a member of the Health Committee of Rochdale) said that to him, it was a unique experience that laymen such as they, should be allowed to listen to such a valuable paper as Dr. Young had presented and hear the various opinions of the medical men. Speaking as a layman he would not deal with scientific questions, but there were one or two points in the paper which he, as one who had been fifteen years on a hospital sub-committee, connected with the Health Committee, might answer from a layman's point of view. And it might do the gentlemen present good to hear a little plain speaking from those who are inexperienced. He was very grateful to the Institute, and to Dr. Young for his paper. He thought it was Dr. Vacher who had thrown out the suggestion that all tramps and others who were up and down the country should have a kind of permit. He thought that would be too great an interference with the liberty of the subject, and he did not think it would be tolerated. That everybody who went about seeking for work should have to go and ask for a permit from a magistrate, he was afraid no public however intelligent and progressive would agree to. They would feel that they were in Russia. Certain restrictions were required, but he could not subscribe to a restriction so drastic. There was the point that The Sanitary Institute should appoint some sub-committee to draw up a mode of investigation, and they should be sent to the medical officer of health. Again, speaking as a layman, he thought that would be a very proper thing to do. If they would send those suggestions to the medical officer of health the latter would give them to his committee, and the committee would give them to the public, and great good would result. In regard to the point about pulling down buildings which had become almost "incurable," so to speak, he agreed with Dr. Young when he said it was too radical a change, from a financial point of view. Even Health Committees, however good medical officers, they might not have had unlimited purse strings that they could afford to pull down

buildings. Speaking for himself, expense was nothing if it would only conduce to the health of the people, but he was afraid the pulling down of buildings would not be accepted. Another question was, should medical officers of health or the medical superintendent of the hospital be called upon to pass an opinion on a case before it was removed? Speaking for himself he should say, Yes. His experience had taught him that they sometimes had cases sent to their infectious hospital that ought never to have been sent, and perhaps if they had had such a provision, it might have meant a great deal more money to be paid to their medical officers of health, but it might pay the committee and prevent a good deal of unpleasantness. Dr. Young made a statement which was rather amusing. He said: "Is it not almost a scandal that a training of only a few weeks' duration should be given to medical students in that branch of professional knowledge on the possession of which in an adequate degree the safety of large populations frequently hangs?" He always thought that the medical men got the greatest knowledge, that it was not only a question of a few weeks, but that when they sent for medical men, and placed themselves unreservedly in their hands, they thought the medical men were sufficiently acquainted with everything and it was not necessary to doubt their knowledge and experience. He was afraid it might make him feel that gentlemen of the medical profession, a profession which he admired, and in which he had the fullest confidence and trust, had not after all had the training they ought to have had. Dr. Young said so. Dr. Young said also, "For how long should cases of scarlet fever, diphtheria, etc., remain in the hospital?" He said, "Trust the medical officer of health. Give him absolute power to discharge when he thinks proper." He had every confidence in their own Medical Officer of Health, Dr. Henry, and was proud of the work he had done. As to the fragment of compensation to those who had been in contact, they had discussed this question, and were afraid they had not the power to give financial assistance in some of these cases. Personally he was delighted to find from this paper, on the authority of Dr. Young, that they could do so, and he would go back to his committee with the information. He thought they ought to have the fullest power to give compensation to those who the medical officer might think were perhaps not infected at the time, but might be in danger. He would then be able to say to them, "It is to the advantage of yourself and of the people with whom you come in contact that you should not go to work for a time." It was only right and proper if they were kept away from work that some compensation should be given to them, and it would pay the ratepayers to assist the unfortunate people.

MR. BLAND (Barton-upon-Irwell) said he rose to pay his tribute of respect to Dr. Young from another branch of the public health service, that of the sanitary inspector. He should like to be allowed to ask whether he would not rather have omitted the word "populous" out of his paper. Because he would doubtless agree that the necessity for the removal of infectious cases was as important

to the non-populous or rural districts as it was to the more populous. He believed that the value of hospital isolation was as great to the smallest rural district as to the most densely populated. His reason for saying this was that the necessity for removal to hospital was very often more a question of the condition of the home itself, and they frequently found in rural districts homes so overcrowded that isolation would be impossible. Six weeks ago a notification of scarlet fever had been put into his hands, and when he had read it he found that the doctor visiting the case had said: "You will remember this family. There are nine children in a two-roomed house,"—all little ones, too, because they had come in twins—"Removal in this one case would probably protect the remainder." He was very glad to say that removal in this case had had the effect of protecting the remainder. The importance of the removal had been as great in that case as it could have been in any case in Manchester. There had been mentioned the question of making a charge for the treatment of patients. Speaking as a sanitary inspector who had to take charge of the actual removals, he should object to that. He said it was not in the interests of the public health that the sanitary inspector or the medical officer of health should go with an agreement in one hand, to ask the parent to sign to repay the cost of the patient, and in the other the power to remove under the Public Health Act to protect the public health. If they had hospital accommodation, they had no right to go to the house with any other intention whatever than that of removing the case. The question of chargeability should not arise unless they were paupers, and then, he took it, the Board of Guardians would deal with the case in the proper manner. There was, however, just one defect in the law. In the Public Health Acts, and in all he had read, there appeared no reference dealing with the peculiar circumstance of a person dying in hospital. It apparently had never been contemplated in the Public Health Act that a person should die in an infectious hospital. There should be some provision to compel the sanitary authority which sent a man, who might happen to be without friends or relations, into the hospital, to inter the body in the event of death. Otherwise one put the responsibility upon the Poor Law of having to deal with a man when dead with whom they had nothing to do in his lifetime. He thought the Act should say that the local authority which removed the case into hospital should be liable for interment in the event of death. Then there was the question of the "bran-bag" which had been mentioned. It seemed to him that that was very similar to many things which people would do when the authorities go to disinfect a house. Before to-day he had known the bed on which a child actually died to be taken away and hidden from view. He had had to go three times to get hold of something which the silly parent had endeavoured to keep out of the way. There was another feature which accounted frequently for return cases—the difficulty one had to encounter in the disinfection of the house. How could one possibly disinfect a house if the family were kept in it? It was a very serious difficulty indeed, and when a case did happen to coincide with the

return of a child from the hospital, they at once said, "This is a return case." No account was taken of the other conditions in existence all the time the patient had been in hospital, the contact the people may have suffered with other cases outside their home, as well as the infection that may have been left in the home. He was anxious that the hospital should stand clear of any liability to blame for "return" cases, because he felt that once it got noised abroad that hospital patients were likely to take infection back to their homes, the difficulties the inspectors had to encounter would be greatly intensified, and people would refuse to let them into their homes. His own idea was that inspectors ought to have at liberty a place where they could take the entire family and have the whole house disinfected in a proper and systematic way. In that way he believed there would be very much less heard of return cases.

MRS. PANKHURST (Manchester) said she was a registrar of births and deaths in the adjacent neighbourhood, and she wished to make one suggestion very briefly. The medical officers of health had given very valuable hints to persons with regard to infectious cases in their houses, but they did not make any recommendation with regard to the registering of deaths which, unfortunately, sometimes resulted from these diseases. A registration office was sometimes a dangerous place as things were at present. Last week a man had come to her office to register the death of a child from scarlet fever. She had asked whether he had been present at the death. He said "No, I was not present, but the child's aunt who nursed it was present and she is outside." She asked him if he meant out in the street, and he said "No, in the outer office," where she was sitting on a bench with several other women. In the office she had seen four women who had come to register births and two nurses. She was in a very difficult position. She did not know whether to order her out or to say nothing about it. She simply hurried her business and let her go. She thought it would be an excellent thing if medical officers would advise persons who were unfortunately obliged to register the death of a person who had died in an infected neighbourhood, not to go in such a condition as to endanger other persons. She wished to express her appreciation of the attention that this Institute had given to this subject.

MRS. SALE (Chorlton Board of Guardians) said she would like to make a suggestion, that until the present epidemic of small-pox was over, the Corporation should remove the cushions from the tramcars. She said this because they had had a case that week of a man, a destitute man, who had gone up to the workhouse in a tram, and directly he got there it was found that he was suffering from small-pox. He had gone at 4.30 in the afternoon, which was always a crowded time, and he had had a seat inside the car.

MR. SHAWCROSS (Withington) said, being a sanitary inspector, he should not like it to go forth, that the opinion of Mr. Bland was the opinion of every

inspector. With regard to medical officers of health visiting patients before they are removed to the hospital, he thought, generally speaking, it was a well-founded rule, that when a medical practitioner had a doubtful case, or something that he was not quite satisfied about, he might communicate with the medical officer of health with a view to a consultation. At any rate that was the way in the locality that he represented. And certainly if a mistake was made he thought it would be a very serious calamity indeed, and not likely to create a brotherly feeling if they were to black-mail—or as he understood, do something to that effect—a doctor if he made a mistake. He should not like such a thought to go forward so far as he was concerned. He was bound to confess, that during the past two or three years they had had serious trouble with regard to scarlet fever. With regard to one case which was removed to the hospital, during about eleven weeks everything went well. Every care was taken regarding disinfection, even to toys. After eleven weeks the child returned home, and before it had been in the house five days they had another case commencing. Another followed, and then another, until each one of the children from that house, together with the mother, had been removed to the hospital. There was certainly here a missing link, which he thought Dr. Young and every medical gentleman who might be present would agree with him, provided food for further investigation. He was not speaking against removal to hospital. In the course of his experience, he had perhaps been the means of getting as high a percentage of cases, as most inspectors removed to hospital. He said, however, that generally speaking, where there was not the facility for properly isolating cases, it only required a little tact and persuasion on the part of the inspector or medical gentlemen to induce people to allow the patients to be removed. He wished to be practical, and did not think it necessary to mention any other special case, but he thought the one case he had given was quite sufficient to point out that this matter, which many medical gentlemen throughout the country were investigating, was well worthy of the expense and time it entailed.

The Chairman (Mr. A. Wynter Blyth) said he would like to make a few remarks in proposing a hearty vote of thanks to Dr. Young. In the first place Dr. Young had made a suggestion, that The Sanitary Institute should print and send out various queries to medical officers of health. This suggestion was a valuable one, and he would undertake that it should be considered by the Council of The Sanitary Institute. Dr. Young had gone over the whole field with regard to the isolation of infectious disease in a complete manner, which all present had appreciated. The meeting was very representative. They had there at the present time members of health authorities, medical officers of health and sanitary inspectors, and, judging from the lady who had spoken, they had also a representative of registrars of births and deaths, so that that paper had been read before a meeting of a most representative character, representative of the practical side of health and sanitation, hence the discussion would, without

doubt, lead to good results. He wished to say a few words with regard to the utility of infectious disease hospitals in preventing the spread of disease. He believed that in a great number of instances they did prevent the spread of disease. But even if they did not do so, even if it were proved that they had no influence in this direction, they were still he contended, at the present time, a necessity, and would always be a necessity, because most infectious diseases ought to be nursed by skilled nurses. These were bad cases of diphtheria, which ought never to be left without a medical man, day or night. Many patients who have been nursed at home have been choked in the night by obstruction of the larynx, whereas, if they had been in a hospital with a medical man two or three rooms off, the ordinary operation would have been performed, and the child would have lived. Again, with regard to typhoid fever, no matter what social position the patient may be in, it was really better for him to be treated in hospital than outside. As an instance of what he meant, he mentioned the case of a medical gentleman who had had an attack of typhoid fever and was now in the convalescent stage. It had been a very bad attack, and his entire system seemed disorganised. He had told him (Mr. Blyth), in fact, that his moral character for the time had quite changed. On one occasion he felt extremely hungry, and fancied something he ought not to have, whether it was mince-pie, plum-pudding, or tripe and onions, he could not say, but it was something bad for him to take. He had a proper skilled nurse and so on, but he had actually deceived the nurse and gone down to the pantry and ravenously eaten of the forbidden food, the result of which was a relapse, from which he nearly died. Hence, with regard to cases of typhoid fever, it was most important he considered to have an institution where people are prevented from playing these kind of tricks by a little stern discipline. The discussion had been as wide as the paper, and it had fairly covered the whole field of the present practical efforts that they were all putting forth to arrest the spread of infection. He quite agreed with Dr. Sergeant and others on the importance of the vagrant question. In the recent small-pox epidemic in the metropolis, it was conclusively proved that the tramp class spread small-pox more than any other, and had it not been for the presence of tramps at the different shelters and so forth, the small-pox epidemic would not have attained the dimensions that it had done. In one case, that of a very large Salvation Army shelter in his own district, he had been able to put pressure on the Salvation Army people by saying that "I must really close your institution unless you consent to have everyone vaccinated who sleeps here to-night, or on subsequent days." They consented, and the public vaccinator had attended and worked up till midnight for about six or seven nights in succession. No one was admitted to that shelter unless they had been recently vaccinated, or had consented to be vaccinated. So instead of that Salvation Army shelter becoming a centre for the dissemination of small-pox, it became the safest spot in the metropolis. The London County Council also had done a great work with regard to the large common lodging-

houses in segregating the contact cases, and paying them compensation. Still, they certainly did want some legislative power to deal with tramps. He could not agree with Dr. Vacher that they could practically give them all a permit. What sort of a permit could that be? He supposed that the only thing that was practicable was to tattoo them with some sort of cabalistic sign. The cost of hospitals was of course extremely large at the present time; but then it was most important to make the hospitals attractive. The reason why the Asylums Board in the metropolis had been so successful in receiving cases at their hospitals was because they were all extremely well constructed and well managed. During his career of medical officer of health in London, he did not think he had been compelled more than two or three times to have recourse to the magistrates to compel the removal of a case. They all went willingly in the metropolis; there was not the least difficulty whatever. He knew in the country it was often very different. In some instances local authorities had provided cheap but unpleasant and badly constructed hospitals, badly managed and repellent in every way. He was quite certain of the fact, that if a local authority provided a hospital at all, they should provide them of the best possible construction, and manage them, as far as possible, so that persons who had, unfortunately, to go there, would feel perfectly at home.

Dr. Meredith Young, in replying to the various speeches which had been made, said that he did not think Dr. Garstang could have appreciated one point which he had mentioned, viz., the importance of the examination of the throat for discharge in cases of scarlet fever. The reason he had mentioned it was not to discourage the examination of the throat before discharge, but to point out that in his experience it had been the rarest thing to find any abnormalities that would enable one to say whether a case should be discharged or not. He was sorry to hear that Dr. Garstang had had an unfavourable opinion advanced against his suggestion that cases of persons who had been in contact could be dealt with under section 126. He ventured to think that if Dr. Garstang got a good case during a small-pox outbreak, he would be sure to get a conviction. With the remarks of Dr. Sergeant, that the hospital should be made more attractive, he thoroughly agreed. It often told further back than the immediate effect on the removals to the hospital. It had been shown that where a hospital was made attractive and was favoured by the public, not only were more cases removed, but more cases were *notified* or brought to the knowledge of the public health authorities. Therefore, if the hospital were made more attractive, it was not only more beneficial to the patients and their relatives, but to the whole community. He could not agree with Dr. Sergeant as the propriety of a medical officer of health seeing cases, accidentally or otherwise, before admission. It might be all right, but one could not help feeling that one was walking on the edge of a precipice the whole of the time, and at any time may tumble into the valley of professional jealousy and suspicion. Then the future

work with the members of the medical profession had handicaps placed upon it which should be studiously avoided. As to the medical examination of cases as soon as they are admitted, he thought that might be extended to include a bacteriological examination. That would not only tend to confirm the diagnosis, but serve the double purpose of discovering co-existent diseases—diphtheria with scarlet fever, and so on. With what Dr. Vacher said as to the provision of small wards in isolation hospitals he agreed up to a certain point. He thought those small wards should be limited to the acute cases, and not extended to the convalescent cases. It was a very serious administrative question how best to nurse a number of cases, but he thought the question had been answered by the experience of a good many men—that for acute cases small wards were best, *i.e.*, wards holding anything up to half-a-dozen patients; for convalescents facilities for nursing were much greater with a large number of patients in one ward, and the expense was considerably less. He was afraid he could not altogether subscribe to Dr. Vacher's suggestion on the question of permits for tramps. He had a good deal of sympathy with the view that small-pox had been and was being spread at that moment to an alarming extent by the careless, casual, and ignorant habits of tramps. In his own town he thought the disease had been almost if not quite confined to the tramp community; people who were not worth twopence-halfpenny from one day to another: and yet the town had been called upon to spend between £1,500 and £2,000 on the isolation of these tramps, so that the rest of the community should not suffer. He thought Dr. Vacher's suggestion might be made applicable to regular tramps, *i.e.*, to what one might call "hereditary paupers"; but for casuals, who only went to the union when they could not get work, who were really bonâ fide union cases, if such persons were granted permits it would only act as an incentive to them to pass from one union to another, and to never bother their heads about looking for work. He could hardly agree with Dr. Wilkinson that small-pox could be isolated in an ordinary dwelling-house except under the most exceptional circumstances. He had never yet seen an instance where small-pox could be properly isolated at home. The great infectivity of the disease and the ease with which an extremely mild case could give rise to a fatal case were two factors which made it appear the best policy to isolate in a hospital only. In connection with the isolation of measles and whooping cough, he agreed to a certain point with Dr. Wilkinson, but thought probably as much good would be done by the work of female sanitary inspectors in supervising home treatment as if hospital isolation were secured by local authorities. He had had splendid work done in that direction during a great outbreak of measles, when they had more than 2,000 cases. He had two female inspectors, and the work they had done in securing proper home isolation and treatment was deserving of the highest admiration. He was glad to hear Mr. Sharpe speak. He thought it was always useful to have lay opinions on these things, and he had personally derived the greatest benefit on many occasions from the opinions

expressed by lay members of his own sanitary authority. Mr. Sharpe was rather hard on medical men, and seemed to think they should be, like Cæsar's wife, above suspicion. They were all human, and therefore liable to err. Mr. Bland had made some statements with which he could not come to agreement about the diagnosis of small-pox. Mr. Bland seemed to think, as Mr. Shawcross had pointed out, that because the medical man made a mistake it would be the proper thing to "black list" him, and publish worldwide the mistake, as a lesson to others. He did not think that would effect any good at all, but rather the reverse. It would probably create the very friction which one was so anxious to avoid. Neither did he quite agree with Mr. Bland that patients isolated in hospital should not be called upon to pay some small contribution for the benefits they got. He thought that what people did not pay for they did not value. If merely a nominal charge of 1s. or 2s. a week were made, he thought patients would appreciate the isolation much more, and the community as a whole would benefit most distinctly. He did not see any difficulty in the disinfection of a house while the occupants were in it. He had had it done from top to bottom, using a spray with perchloride of mercury or some other disinfectant, and taking one room at a time. But in districts where the old-fashioned fumigation was carried on, there would be difficulty in disinfecting even one or two rooms while the family were there. The authorities had power, of course, to provide shelters for any persons displaced during disinfection. He was glad the Chairman drew attention to the life-saving influence of isolation hospitals. It brought home to him the fact that they must look to the individual benefits of isolation in hospitals, and not rely so much on bald statistics. They must look at the units as well as the hundreds and thousands.

DISCUSSION ON THE PRESENT SHORTAGE OF WATER AVAILABLE FOR SUPPLY.

Opened by
W. WHITAKER, B.A., F.R.S., F.G.S., Assoc.Inst.C.E.
(Fellow.)

Sessional Meeting, February 11th, 1903.

MR. WHITAKER observed that he would be inclined to improve the title by simply saying "Shortage of Water" without regard to the purpose of supply. There can be no discussion on the main question "Is there a shortage of water?" and he would therefore take it as proved. But nowadays people are never satisfied with a fact, but always want to know the reason why. The real question at issue therefore is "Why is there this shortage of water?" and this was the point to which he wished to direct their attention mainly. He would not go into figures and details except when such were necessary to illustrate the general question, but he desired simply to place a few considerations before them as to the varied aspects of the matter, and he would endeavour to do this as fairly as possible.

They could class the reasons why there is a shortage of water into two, the artificial and the natural. With regard to the first, the artificial reason, that is the one on which there is the most controversy; water supplies are roughly divided into two classes, one, gravitation works, with great collecting areas and large reservoirs, and the other (underground) by means of wells and pumping stations, with very small reservoirs. As regards the artificial shortage of water the case has mainly to do with the second class of supplies.

Attention had been called to one reason of artificial shortness in regard to gravitation supplies, and it is a reason that is fairly manifest, namely the insufficiency of reservoirs. If reservoirs are not big enough to impound a large amount of water that would otherwise run to waste in floods,

naturally there will be a shortage when the dry season comes. Large reservoirs, however, are very expensive things, and that is perhaps the explanation why in many cases corporations or companies (that evening they had nothing to do in distinguishing these two) have not increased their storage power quite so much as they might do. There are, however, some exceptions. There is an exception in London, because while we are hearing of shortage all over the country there has been no complaint of a shortage of supply in London. If the companies that have charge of the supply of London had not increased their storage as they have done largely of late years he felt sure that we should have had very many deep complaints. There have been complaints at odd years of this company and that company, but at the present moment and for some time past there has been practically no complaint at all. Therefore we may very well consider that the people of this great city are well off in the amount of water they get. Some of the difficulties of a water supply increase perhaps as the square of population increases, that is not directly, but at a much higher rate; so that London is really very well off in this matter. He was not advocating the present sources of supply, or the present way of administering the existing supply, but he was always inclined to give the Devil his due even when the Devil comes in the shape of a water company. So far as gravitation-supply is concerned, the chief reason then why there should be such a shortage in some places is because the necessary basin to hold it has not been made large enough; there is a great deal of water in flood time, and this is allowed to run to waste.

Turning, however, to underground water supplies, we find a very different state of things. It has been noted for many years that the water from springs is lessening, and that the water-level of wells is falling, and there are various other phenomena which show that there is in some places less water than there used to be in the past. What are the reasons? First of all, many persons say that too much water is pumped out of wells by the pumping stations in a given area. It is said that so much water is taken from the wells that the water-level is lowered all over the area, or a great part of it. Now, if there is a great deal of pumping-out of any watershed, that this must have an effect on wells can hardly be denied; but it has to be remembered that the effect depends largely on the how, the when, and the where of that water being taken. If there is a large watershed on chalk or New Red Sandstone (the two chief permeable formations), the result of pumping depends a great deal on where the wells are placed, and how the pumping is done. Here controversy comes in. It stands to reason, that if there is a set of springs (which are the outflow

of the underground water), and pumping stations in places near those springs, drawing from the same source and with heavy pumping, the springs must be affected. It will vary much according to local circumstances how much the springs are affected. If they are small springs and very near the works they may be dried up utterly.

We had proofs of springs having been dried up by heavy pumping. The strongest case he had ever known was that of some springs issuing from a little chalk valley, and of a stream flowing down from them for two or three miles into a tidal river. The flow there might have been some millions of gallons a day, varying according to circumstances. A few years ago a water company established a pumping station a little above the springs, perhaps a mile and a half, and that company took a million gallons a day. Since the establishment of this pumping station the springs and stream have dried up. The natural thing for anyone to say is, that the water company having put the pumping stations there have pumped the springs dry, or at all events have greatly lowered them. On the face of it this seemed to be possible. But they must examine a little further. Going a little down the stream and a little below the springs, some manufactories had been erected requiring a lot of water, and they took it in the same way as the water company, and, on the whole, to a greater extent.

He was, however, inclined to think that if this were all there would still be water in the stream, although the flow might be diminished; but there is another occurrence in this case which makes it unique. A company wanted to quarry there. Pumping the neighbouring wells had dried little sheets of water in an old chalk pit, which had been dug down to very nearly the water-level in the chalk and then left, because it did not pay to go any deeper. The chalk pit had become dried; so the company reopened it at a lower level and got the benefit of the pumping done next door. Then they say, "Well, what if we pump ourselves?" and now, simply for the purpose of quarrying out of that lower bed, seven million gallons a day are pumped to waste. This may not be all fresh water, but most of it is: say two millions of this seven millions are not fresh water. Well, that left five millions taken from the chalk, and with the two or three millions taken by the other means described, that meant that some eight million gallons a day of water are taken from a comparatively small area, and so, very naturally, the springs cease and the stream comes to an end. This is a case in which it is practically proved that the greater part of the water is not taken for supply of any sort, but is actually pumped to waste into a tidal river.

There are other cases of a somewhat similar character where the effect is less, and there is more doubt about the matter. That five millions of gallons of water should be pumped to waste daily seemed to him wicked. But under the present law it could not be helped, anyone can pump the water and discharge it into a tidal river provided no damage is done to the land between the pumps and the river. The fact showed how complicated the problem of underground water is, and that public supplies and private supplies must alike be considered. A case of this kind shows that we really want some public interference, or some public rule as regards underground water. What it will come to in the end—whether government will nationalise all the underground water and sell it privately or publicly, or what else would be done we do not know, but the need for something to be done is manifest.

There are cases where fairly heavy pumping goes on with very little result, and his experience is that a general rule cannot be given in all these matters. Every case must be treated on its own merits, and all the local circumstances must be examined before a proper explanation of the cases of the shortage is obtained, and he hoped that every interest concerned in this matter would be thoroughly represented that evening.

There are many other questions to be considered as well as the shortage; the character and value of the supply are also important things. The wholesale waste of water also needs attention, for as in the case of the Mersey Tunnel, where pumping has always to be done to keep it dry, a mixture of salt and fresh water is pumped to waste, and perhaps this drawing in of salt water may affect some of the neighbouring wells. This is a matter which obviously should be seen to. There is also the case of the Severn Tunnel, where many million gallons a day of fresh water are pumped to waste, and something ought really to be done to prevent such great waste.

Leaving, therefore, the question of the artificial causes, they should next consider some of the natural causes. He had correspondence with persons in various parts of the country which showed that the present shortage is widespread; cases were quoted of springs and little streams, far away from any pumping, which had dried up. There is a large amount of evidence that something of a general character has been going on. The artificial cause of shortage, though powerful in many places, is confined to certain areas, but the natural cause spreads over far wider areas, and may be less direct in its results. Many important towns, like Bath and Leicester, are suffering seriously from the failure of gravitation supplies. Reservoirs which ought to be well filled are seriously short of

water. Pumping cannot affect these because in such a case only surface water is taken.

It is a curious thing that while the main streams and springs have gone very low of late, the surface springs—small ones which one would think would be seriously affected—have run on as steadily as usual. The gravel-springs in places had much water, whilst water from other sources had largely failed.

Manifestly, one cause of this natural lowering comes to the front directly, namely, that there has been a great decrease in the rainfall. This is not a matter which can be doubted. Dr. Mill, whom he was glad to see present, would perhaps speak to them on this point, but figures for the past seven years or so, showed, that roughly, we are a year short in the rainfall, or, in other words, that there has been a shortage of about a seventh part of the rainfall, and unless there is a good fall coming, this large deficiency cannot be made up, except by storage, for purposes of supply. Dr. Mill could give them the actual figures. There are favoured places where there has been an excess of rain, but there are more places, over the whole of this island, where for many years there has been a great deficiency in the rainfall. What is the reason of this deficiency? Personally he thought that the cutting down of woods and the deforestation which has been going on in this country for many years may have something to do with the decrease in the rainfall. Then with regard to surface-water, the improved drainage may also have contributed by allowing the water to run off the land quicker than it would do naturally. Possibly on this subject their meteorological friends would explain some of the facts, and would supply some other information.

It seemed to him that another matter was worth inquiring into, namely, whether this seasonal cause of shortage (from a succession of dry seasons) is supplemented by any secular change. If we had the records of a good long past, he thought we might see that there are things which point to the existence of secular change. One notable case of this kind had been brought to light by the antiquarian researches of the late General Pitt-Rivers on his estate at Wimborne Chase, on a high chalk area. The conditions here provided a fair test, because any decrease in the rainfall would tell quickly on the underground water-level. Nature, curiously enough, had supplied a measurement for a great many years, perhaps 1,500 or more. General Pitt-Rivers discovered a great many Roman remains, and amongst them were two wells in chalk, which were dry, their bottoms being above the present water-level in neighbouring wells. Now, the Romans were an extremely practical people, and good water works

engineers, and they would not have dug a well in a spot of that kind to within a few feet of water—they would have gone on and got to water. It was reasonable to infer that in Roman times there was water to a depth of a few feet in the deeper of the two wells, especially as the remains of a bucket were found in it. It would be interesting to make further examination of that well, by boring deeper, and to find how far the water is from the bottom of the well, as the modern wells are some way off. He was inclined to agree with General Pitt-Rivers that in Roman times there may have been a greater rainfall (over a large number of years, not merely six or seven) and that natural changes had occurred which had led to the lowering of the water-level in the whole of that chalk tract.

It has been shown that trifling astronomical changes sometimes have a very large climatic effect. How do we know that something of this sort has not occurred in the past thousand or two thousand years? There is evidence that land is much drier over large areas, where there is no pumping to account for the change, than formerly, and he thought there is room in this direction for inquiry whether there is not some secular change affecting climate, and decreasing the rainfall. If meteorologists could give attention to this he thought they would be able to throw additional light on our difficulties.

These were the main points to which he wished to draw attention, he had tried to notice them fairly and on general principles, in such a way as to enable those present to discuss the matter in a more detailed or more special manner.

The Chairman (Sir Alexander Binnie) said they had listened with a great deal of interest to the remarks of Mr. Whitaker, who certainly had placed the matter before them from many and diverse points of view. The subject lent itself to discussion. If the facts of the subject were known there would be little or no need for discussion. It is simply because the shortage of water, be the cause natural or artificial, is surrounded by numerous unknown quantities that makes the subject not only interesting but important. From what we see going on around us, before long some steps will have to be taken to guard the water supplies of this country from the possible dangers pointed out by Mr.

Note.—Since the meeting I have heard that in the work for the Sodbury Tunnel, on the new Great Western Line, seven or eight million gallons of water are pumped away daily, to waste, with some effect on the surrounding country. Probably a good deal of this is transferred from one watershed to another, as has happened with railway-tunnels elsewhere.—Author.

Whitaker, to whom he had much pleasure in proposing a vote of thanks for inaugurating the discussion.

Mr. John Hopkinson (Watford) said that in discussing this question he would take a different view of it from that of Mr. Whitaker; he would give the meeting a few dry figures, for he thought that this was a question in which they must go into figures, though they could not be made so interesting as the general observations of Mr. Whitaker. He would treat almost entirely of Hertfordshire, chiefly because he was best acquainted with that county, but also because it contributes in respect to its area an undue proportion of the water with which London is supplied. He would first deal with percolation, on which several series of experiments had been made, the results for the 42 years 1842–1884, at Nash Mills, Hemel Hempstead, being of most importance. The year was for the twelve months ending 31st March; winter comprising the six months from October to March, and summer the six months from April to September. In a percolation-gauge three feet in depth with grass growing on the surface of the soil—the ordinary soil which covers the Chalk in that neighbourhood—the summer percolation was 10 per cent. of that of the year, and the winter percolation was 90 per cent. This showed how very much more we are dependent for our water-supply from underground sources upon the rain which falls in the winter than we are upon that which falls in the summer. In corroboration of this fact was another series of experiments made at Lea Bridge, a little beyond the confines of the county, for the 21 years 1852–1873, the summer percolation there through three feet of soil with grass growing on the surface being 12 per cent. of that of the year, and the winter percolation 88 per cent. The annual ratio of percolation to rainfall at Nash Mills was 24 per cent., and at Lea Bridge 27 per cent. It might be fairly added that not all the water which percolates through 3 feet of soil in a chalk district will get so deep down into the chalk as to be available for water-supply, for the roots of trees bring up the moisture from a much greater distance than 3 feet. These experiments were on percolation when grass is growing on the surface of the soil, but when the surface is kept perfectly free from vegetation the percolation is very much greater, and there is not, as might be imagined, anything like the difference between that in the summer and that in the winter. At Rothamsted, Harpenden, for 31 years, 1871–1902, through 5 feet of soil, purposely kept perfectly free from vegetation, the summer percolation was 26 per cent. of that of the year, and the winter percolation was 74 per cent. The annual ratio of the percolation to the rainfall was 48 per cent.; that was to say, under those artificial conditions about twice as much rain percolated as when grass was growing on the soil. The actual annual rainfall at Nash Mills during the 42 years averaged 27·40 inches; at Lea Bridge during the 21 years 25·94 inches; and at Rothamsted during the 31 years 29·01 inches. Turning to the question of rainfall, he would first give the results at ten rainfall-stations in Hertford-

shire for the fifty years ending March, 1892, with a few exceptions for the earlier part of this period, the gauges being very evenly distributed over the county, and the necessary corrections having been made for the earlier years when all the gauges were not in operation, in accordance with the plan followed by the late Mr. Symons, so that the result must be fairly accurate. The summer rainfall in this period was 13·24 ins., the winter rainfall 13·09 ins., and the year's rainfall therefore 26·33 ins. For the last ten years (1892–1902, April to March) the summer rainfall was 11·30 ins., the winter's 13·36 ins., and the year's 24·66 ins., so that during the last ten years the rainfall had been between an inch-and-a-half and two inches deficient per annum compared with that of the previous fifty years. But the winter rainfall during the last ten years was 2 per cent. above the mean, so that there ought to have been an increased percolation, and even for the last three years the winter rainfall was 1 per cent. above the mean. When, however, they came to the last year—from 1st April, 1901, to 31st March, 1902—they had a deficiency of 22 per cent. in both winter and summer, but that was the only year but one during the last ten in which there had been any great defect in the rainfall. This deficiency was not very exceptional, for the winter's rainfall in Hertfordshire in 1849 50 was 37 per cent. below the mean, in 1853–54 32 per cent., in 1858–59 30 per cent., in 1879–80 52 per cent., in 1890–91 35 per cent., and in 1897–98 30 per cent. below it, all being considerably greater defects from the mean than the 22 per cent. in the winter of 1901–02, and the year's rainfall would tell much the same tale of greater deficiencies than that of last year. There must, therefore, be some other cause for the gradual lowering of the water in our underground chalk reservoir which had been going on for many years and had been much accentuated during the last few years, and he thought that what he was about to say with regard to the effect of pumping from great depths upon the flow of the Chadwell Spring would be rather astonishing. It was to convey water to London from this spring for the entire supply of the metropolis that the New River was made, and until the autumn of 1898 there was no suspicion that the spring would ever cease to flow. Its generally accepted mean flow up to the year 1875 was 3,600,000 gallons per diem, this being the estimate of the engineers of the New River Company up to the time of the present engineer, Mr. Joseph Francis, to whom the speaker was indebted for the more recent particulars of its flow—which he was able to give, through the courtesy of Mr. Francis, up to last June. It takes a considerable time for the rain to produce its maximum effect upon the spring, its flow corresponding much more nearly with the rain three months after its fall than at the time of its fall, and therefore the figures about to be given were for the year's flow to 30th June compared with the rainfall to 30th March. For the nine years 1875 to 1884, the mean flow was 3,540,000 gallons per diem, the winter's rainfall being 12 per cent., and the year's rainfall 16 per cent. above the average, a very wet period with a slightly decreased flow of the spring; for the

next nine years, 1884 to 1893, both the winter's and the year's rainfall were 3 per cent. below the average, but the spring fell off to the extent of 26 per cent.; and for the last nine years, 1893 to 1902, the winter rainfall was 3 per cent. above the average and the year's rainfall was 7 per cent. below it, which, from what had been said before, would be seen to have been a favourable distribution of the rainfall over the year for percolation, yet the flow of the spring was reduced to less than half its normal amount, being 55 per cent. below the average. For the last three years, 1899–1902, with a winter rainfall 1 per cent. above the average and a year's rainfall 9 per cent. below it, the spring fell off to 837,000 gallons per diem, being 77 per cent. below the average, or less than one-fourth its normal flow; and, lastly, for the year 1901–02, with a winter's and a year's rainfall 22 per cent. below the average, the mean daily flow of the spring was only 2,660 gallons, being 93 per cent. below the average, or about one-fourteenth its normal flow. The result really was that the spring had ceased to flow, for if it were left to itself it would take in more water from the River Lea during the summer than it gave out to the New River in the winter. It ceased to flow in the autumn of 1898 for the first time in its history; it was hoped that it would never again cease, but it had since ceased and would continue to do so every year now unless they had an exceptional rainfall. In fact, of late years, during the whole summer, instead of water flowing from the spring into the New River, the River Lea has had to be kept from flowing into the spring by a dam being erected across the cut which should convey water from the spring into the New River, the head of which was until the year 1898 the Chadwell Spring. There could, he thought, be no question but that this was due to water being pumped from great depths in the Lea Valley, and chiefly to the pumping of the New River Company at Broadmead Well, near Ware. It was not due to increase of local supplies—to increased pumping at Hertford and Ware for the supply of those towns, for they were not progressive, their population only slightly increasing. The reason was that London took from the valley of the Lea an increasing and undue quantity of water, and he thought that the figures which he had given were sufficient to prove that the water companies were lowering the water-level in the Chalk of Hertfordshire. That might be only an auxiliary cause of depletion, as Mr. Whitaker had pointed out; for the water-level had been going down in the Chalk in the county for many centuries, and he thought that one contributory cause of this might be the cutting down of forests. The county was intersected by valleys which must have been formed by streams which had long ceased to flow, for those valleys were now permanently dry. Then, too, there had been an alteration in the character of the flora of the county. In the neighbourhood of Hitchin a lake-bed had been discovered in which the seeds and leaves of plants had been found, and these were nearly all water-plants or water-loving species (hygrophiles); those now growing in the neighbourhood being heat-loving (xerophilous) species which thrive on a dry soil. There were other indications that Hertfordshire

had once a very much wetter soil than it has now, and he thought that Mr. Whitaker was right in his view that there was a secular decrease in the rainfall, the cause or causes of which would be very difficult to ascertain, and it might not be appreciable in historic times. All he wished to point out was that a depletion in their underground chalk reservoir, under London as well as in Hertfordshire, which had been going on for many years, many ages, had undoubtedly been accelerated by the abstraction of water for the supply of London. It must come to pass that in the course of time they would have to go to a greater distance for their water than the Thames basin. They would have to go where the rainfall was very much heavier, and he thought it was a great pity that this question had not been taken up more seriously in regard to the present purchase of the water companies' undertakings. Arguments had been advanced against the idea of going further afield, chief among these being the expense, but it would be no greater expense to London in proportion to its wealth or to its population than it had been to Glasgow in taking water from Loch Katrine, or to Manchester in taking water from Thirlmere.

Dr. H. R. Mill (London) said he proposed to deal with certain broad facts concerning the British Isles as a whole that might afford some help in regard to the practical problem. However seductive theoretical considerations as to the cause of the present shortage of water may be, they were not likely to help anyone to remedy it. The data available for the discussion of variations of rainfall were now abundant, and in the researches of the chairman, Sir Alexander Binnie, and especially in those of his old friend, Mr. Symons, they had been worked up to a considerable extent. He would not enter into the question of the possibility of secular change. No doubt in the geological past there had been many changes in the amount of the rainfall associated with changes in the geographical conditions, but in the historic past, concerning which alone they could speak with any positive knowledge, they found that the variations which had taken place had not been in one direction, but rather from a succession of spells of wet and spells of dry years. Such at least was the result of considering the investigation published by Mr. Symons in "British Rainfall," 1891. Mr. Symons there produced a diagram, probably familiar to many present, showing the rainfall for each particular year from 1726 to 1891 at a limited number of stations so selected as to be representative of the whole of England. That diagram showed no definite periodicity of rainfall such as would conform to cycles of sunspots or lunar periods, still there was abundant evidence of the occurrence of wet and dry spells. They found the suggestion of a curve running through the series and dividing it into groups of years on the whole, above or below the average. Those groups ran thus: *42 years dry*, 26 years wet; *29 years dry*, 20 years wet; *43 years dry*, 15 years wet; and, extending the diagram to the present date, *19 years dry*. He thought that the exact lengths of these periods would probably be determined in a different way by different people, for all one could

go by in such a case where the individual years vary greatly was the general trend of the series. However, it seemed clear that dry periods tend to be longer than wet periods, or, since the average rainfall was preserved, the wet years were more extreme but less numerous than the dry years. Since 1865, thanks to the establishment of "British Rainfall," data were both more numerous and more exact than for earlier years, and using the percentage of the total mean falls for the British Isles in Table V. ("British Rainfall," 1901, p. [132]) as 100, they found:

Mean of	7 years,	1865—71	= 100	or average.	
„	15 „	1872—86	= 108	„ + 8	per cent.
„	15 „	1887—1901	= 92	„ − 8	„

Although the figures refer to all the stations reporting maximum falls, the number of English stations preponderates greatly, and the result, though comparable year by year, did not apply to any particular part of the country. The broad fact was that the deficit of rainfall in the last fifteen years was equivalent to the normal fall of one and one-fifth a year; the excess of rainfall in the previous fifteen years had been just as great; but unfortunately there was no way of laying by rainfall for future use, and the one could not be set off against the other. A very dry year following on a series of dry years, as 1902 had done, must on the other hand, to a large degree, have a cumulative effect if the word could be used in its negative sense. This question had very recently been treated with reference to the alarming shrinkage of the Great Salt Lake in Utah, the movements of which follow the rainfall very closely (see L. H. Murdoch in the "Monthly Weather Review" for October, 1902), but the attempt to work out a definite cycle there had failed. If the long diagram of English rainfall already referred to could be trusted, the longest dry periods have included the following numbers of consecutive years with a fall never exceeding the mean: 1729–33 (5 years), 1738–50 (13 years), 1752–62 (11 years), 1800–15 (16 years), 1853–58 (7 years). To these they must add the five years 1895–99, when the average for the British Isles was never above the mean, and the deficit averaged nine per cent. During the last fifteen years the average for the British Isles had only been above the mean on three occasions (1891, 1894, 1900), to the extent of six per cent. on each occasion. During the very wet period 1875–79 (five years never below the mean) the average excess was thirteen per cent. Although on the whole the British Isles had suffered from insufficiency of rain during the last fifteen years, there were great differences in the degree of drought, and in some isolated spots there had actually been an excess. Thus for the ten years 1890–99 the English Lakes, southern Scotland, the west of Yorkshire, Durham and Northumberland, and the north-west of Wales, had had a rainfall somewhat in excess of the average for the thirty years 1870–99. Ireland and all of Scotland except the south-east (where there was a deficit) had a nearly normal fall; but the whole of England and almost all of Wales were much in defect. It had often been noticed that the rainfall of the Lake district and that

of central England varied immensely, the one being in excess when the other was in defect. For the decade 1890–99 the drought was most severely felt over a roughly horse-shoe shaped area of central England, the toe at Gloucester, the heels at Matlock and Boston, within which the deficiency averaged from fifteen to twenty per cent. The counties most affected were Stafford, Worcester, parts of Shropshire, Hereford, Gloucester, Warwick, Oxford, Northampton, and Lincoln. The deficiency was very distinctly less in Leicester and Nottingham in the centre of the horse-shoe. The condition of rainfall in central England had been that the eight dry years 1887–94 led to five still drier, 1895–99, and after one normal year to two more, 1901–2, with a deficiency of twenty per cent. No matter how the fall was distributed during the year that persistent deficiency, which to the best of his knowledge had no precedent in recent years, must have the effect of reducing underground supplies. What was most interesting at the present time was to find any clue that would tell them when the long dry period was coming to an end. He could not say anything positive about that. He could only say this, that there was no sign of an increase in the number of very dry years, but there were indications that the driest years were becoming rather less dry; and looking back through the long series it had frequently been found that the approach of a wet spell was heralded by a decrease in the dryness of the dry years, rather than by an increase in the wetness of the years that exceeded the average. But whether this dry period would go on for another year or another ten years, or even another twenty years, it was impossible to say. Ultimately it may be that they would get some light to help them to answer that question. A great many people were searching for a clue, and it would certainly be a result of enormous practical importance if it could be obtained. They knew that the present dry period would come to an end; they might be near the end now, or they may only be in the middle, and consequently it was desirable to take precautions to utilise the amount of water supply that was available for them. There was no doubt that there was plenty of it, if it were only conserved and used in the right way.

Mr. Baldwin Latham (London) said that he possessed a number of records with regard to the question of underground water, and there was no doubt that both last year and this year in the Southern and Midland districts of England there is a considerable deficiency in the underground water supply. In many cases this had been intensified by the very large amount of pumping that had taken place during this low period at certain water-works drawing their supply of water from the ground. The seasonal fluctuations in underground water were generally greater than those produced by pumping in most districts, but pumping was severely felt in low water periods. In the year 1539 there is a record that the River Lea was nearly dried up, and the people living in the neighbourhood were subject to pestilence in consequence. The same thing again happened in 1662. During the recent drought the River Lea was not nearly

dried up, but it has generally been extremely low owing to the influence of pumping which has taken place in this low water season. With regard to modern times, the waters of the North Downs were lower in 1874 than they have been in any period since. In other places last year there was less water than in 1874. In the valley of the Wandle there was a considerable dearth of water last year. No doubt this was due in part to the enormous pumping in London in following the advice of those gentlemen who said you had nothing to do but to bore down under London to get an unlimited supply of water. Where does that water come from? It comes from the various streams which are flowing in the immediate vicinity of London, the Wandle being one of them which flows over the outcrop of the Thanet Sands, and it has been found that upwards of ten million gallons a day in the dry period has been known to flow out of the Wandle into this sand bed which goes to furnish the underground water under London. The same thing happens on the north side of the River Thames. When investigating the underground supply some time ago it was found that considerable volumes of water came from the valley of the River Lea. That is how this unfailing source of supply of water is secured by the wells under London. The sources of these underground supplies mainly depend on the period of the year when rain falls. Summer rain on the average is of very little use for supplying springs and wells with water, and it is the winter rain which takes place from October to March to which the replenishment is due. The peculiar thing about last year was that although there had been such a dearth of underground water, yet it was a year when percolation had been taking place during the greater part of the year. There were only two months last year in which no percolation took place, the months of July and August, and a large volume of water percolated through the percolating gauges so late as in June. The consequence was that they had high water in August at a time when we generally get near to the minimum. Had it not been for this fact and that much percolation had taken place during so long a period of the year, the supplies of water in the Southern and Midland parts of England would really have fallen to a lamentable extent, but fortunately the supplies have been throughout augmented slightly from time to time. The underground waters are now rising, but he had always found that unless the water supply was replenished in the month of December each year, they could never hope to get the deficiency fully made up in the following year. Last December the level of the underground water had been below the average, and it had partly been made up for by the percolation last month (January), but nothing like the amount of winter rain had fallen that was necessary to give a full supply during the present year. There could not be any better criterion of the quantity of water stored in the chalk area in the South of England than the appearance of what is called the Croydon Bourne-flow, which the old chroniclers used to describe as "the woe water of England," because it was said that when it broke forth it presaged death, pestilence and war. The Croydon Bourne flowed every year from 1876 to 1883 or

for seven years continuously, it flowed in several years subsequently and it last flowed in 1897, but since 1897 we have had six years without a Bourne-flow. No doubt we shall have the Bournes again, and the springs will come back and flow as in the past. With reference to surface-water supplies, what has to be done is to take advantage of the periods of abundant supply and store up the water for use during the minimum period. With regard to surface reservoirs or supplies he was glad to say that in most works with which he had to deal, these sources of supply at the present moment were in a better position than they had been for some time past.

Mr. F. W. Verney, London County Council, said there was no one present who was not extremely anxious that the water supply of this great city should be pure and plentiful. There were some facts to which he should like to refer, and which would be of interest to anyone practically interested in the water supply of London. In the year 1893 there was a Royal Commission, the Chairman of which was Lord Balfour, and this Commission gave as its verdict on the water supply of London, that the average daily flow of the Thames at Teddington Weir, allowing for the water taken by the companies, is about 1,000 million gallons. This average estimate has been since found to be much above the actual flow, so that the present position of things is a matter of grave anxiety for all interested in the water supply of London. In the three months from July to September 1898, instead of 1,000 million gallons a day flowing over Teddington Weir, this had been reduced to 135·8 million gallons, and taking the three periods from May to October 1899, it had been reduced to 235·8 million gallons. From June to November 1901, the amount was 237 million gallons a day. The average daily abstraction from the river during the last 20 years was as follows:—in the year 1883 the daily average of water abstracted amounted to 70 million gallons, which gradually rose, until, in 1900, 120 millions a day were abstracted by the companies for the supply of London, and the latest figure was from 135 to 136 million gallons a day, Under all the circumstances it is not surprising that there is a very serious shrinkage of water. One conclusion they could draw from the evidence laid before them that evening was, that London ought to have an adequate supply of water, not liable to the uncertainty of which so much had been heard that evening, and that the water should be sufficient in quantity and be absolutely good in quality; wherever we have to go for that water, his firm conviction was that, no matter what we have to pay for it, it will be cheap if we get the amount of pure water which the greatest and richest city in the world requires to keep its population healthy. He doubted if the average Londoner takes the trouble to calculate the fearful loss that is suffered every year from the preventable disease which comes from the shrinkage of water. This was a subject which had not been touched on that evening, but supposing there are one million workers in the metropolis, if the loss was only put down at

one hour per annum for each worker for preventable illness—and it was a ridiculously low estimate—this would work out at more than five years loss of labour, loss which the workers suffered per annum. Therefore the question is a question for practical workers. Londoners ought to look the facts of the case in the face, and look to men of science to guide them in accordance with the facts as they observed them. Scientific men are too honest to prophesy as to what the future will be, but as people of common sense we must look a little beyond our noses, and insist on London being provided with good and ample water supply for the next 30 or 40 years as an absolute essential to the health, and the very life of those who inhabit London.

Mr. Clayton Beadle (London), as representing an Association formed less than a year ago, in consequence of the disastrous state of affairs in regard to the sources of London's water supply, said that a good deal of information with regard to the subject had come under his notice. Apart from the general welfare of the public there was one important question which had been hardly referred to that evening, namely, the many industries round about London and in the Home Counties, which are largely dependent upon a copious supply of water to carry on their operations. These industries, no doubt, will in a measure have to suffer with the rest of the community, but if deprived of the water which is essential to their progress these industries would be extinguished. It had been said by Mr. Moseley that there was an abundant and almost unlimited supply of water in what is known as the London Basin, but by his own (Mr. Moseley's) statements there were a thousand private wells pumping on an average 100,000 gallons each per diem from the London Basin, giving an aggregate of 100 million gallons from private wells alone, or a total of 150 million gallons per diem if the Metropolitan Water Companies are included. This estimate he thought was a moderate one, although he did not believe there were any exact figures with regard to this abstraction of underground water. The effect of this pumping could be understood when the fact is known that the overflow of underground water from the London Basin, which takes place into the Thames near Erith, is not so marked as it formerly was. In and around London there are some four hundred brewers who are continually abstracting water, and various paper manufacturing mills which could not possibly get on without large quantities of water. Such industries must have the water at their feet, they cannot go afield for it. It could therefore be seen that there are all sorts of variable causes contributing to the abstraction of water, of which there are no reliable statistics. In regard to the water in the chalk, the opinion once held was, that the amount of water available for pumping was the actual amount of water contained in it, but that has been altogether overthrown. He explained why it is that the amount of water actually available for pumping is considerably less than this.

Mr. Douglas Archibald (London) said he was glad to be able to add a note of optimism to the general tone of the meeting. He was inclined to agree with Dr. Mill that there is no secular or progressive meteorological change to account for the recent drought. On the contrary, this drought fits in remarkably well with the dry part of a cycle which is so well determined that he was inclined to accept the challenge and prophesy that this present drought will shortly come to an end. He was glad to have some evidence to support this view, and he referred particularly to Dr. Bruckner's important publication "Variations of Climate," published in Leipzic in 1899, which he had read in the original German during the last six months. The author had made a complete study of climatic variations in all parts of the world, and the evidence in this book shows that from the year 1691 recurring cycles, similar to those referred to by Mr. Symons and Dr. Mill as applying to the British Islands, have been worked out for the whole of the world, from 1691 up to 1885. The mean length of the wet halves of the cycles is found to be seventeen and a half years with a probable error of one and a half years, and the mean length of the dry half of the cycles is eighteen years with a probable error of one and a half, so that the lengths of the entire cycles are about thirty-five and a half years. These figures agree substantially with those for the lengths of the cycles for temperature, for the barometric pressure, for the heights and depths of lakes, for the depths of rivers, and for almost any other phenomenon that has been measured. What effect has this upon the point at issue? Well, it is this: that the present dry cycle having commenced in 1886 we have now had sixteen dry years, or very nearly one complete dry phase of the Bruckner cycle. Judging from the past we may say with some confidence that this present dry period is likely to come to an end about 1905–6. He did not wish to be considered as prophesying this, but he desired to point out the evidence in favour of this view, and that the only way in which an opposite state of things could occur would be by a sudden and unprecedented breaking down of Bruckner's cycle. The years from 1906 to 1921 ought, on the whole, to be wet. The amount of the range of amplitude is found to be various in different parts of the world, and is 16 per cent. of the total for Europe, 30 per cent. for Asia, 26 for North America, and 28 for South America. Under these circumstances, and in the face of so many verified figures, he could not help regarding this as giving us good ground for believing that the recent drought would soon be reversed.

The Chairman (Sir Alexander Binnie) said under the circumstances they must congratulate The Sanitary Institute upon having initiated such a useful and interesting discussion on that important subject. There are two facts quite apart from the theories of cycles of wet and dry seasons which should be borne in mind by those who have studied this question. The Royal Commission presided over by Lord Balfour stated in their report that a great deal of evidence was laid before them of a more or less controversial character, and the difference

of opinion among engineers and others was very conflicting; but on one subject the Commission said there is no doubt whatever, and that is, that the level of the water in the chalk under London is falling at the rate of 12 to 18 inches per annum. At the commencement of the last century, when an artesian well was first sunk in London, the London basin overflowed. There was a recorded case in Hammersmith, where on a well being sunk the water rushed up with such violence that it destroyed two cottages. At the present time in the neighbourhood of the Thames the water in the chalk under London is 100 feet below high water mark. These are facts which cannot be disputed, whatever may be the cause of them, and he did not propose at the moment to attribute any cause. Turning from the Thames to the Lea, attention should be called to a remarkable fact. The New River Company had known that valley from the time of James I.; by recent legislation, and the works which they are carrying out, costing over a million of money, this Company is now going twenty miles to the Thames at Hampton for supplies. Whatever opinion might be formed of the Lea Valley water authorities one must give them credit for being far seeing men, and when they abandon old sources for new sources, and spend large sums of money, it is a good proof that the water in the Lea Valley is decreasing, or, at all events, if not decreasing they have got to that point where they can obtain no further supplies. Another important fact in Lord Balfour's Commission's Report with regard to the Lea Valley was this, that the lower part of the valley is such that the water in the chalk is below the ordnance datum for the United Kingdom. If that be the case, supplies of water cannot be passing down the Lea Valley into the Thames, unless there is some unknown power which will force that water to go uphill.

The following communication from Mr. W. Watts, Water Engineer, Sheffield, was submitted to the meeting:—

The writer assumes the subject of "The present shortage of water available for supply" to refer to the collection and impounding of water for domestic use throughout the country.

Two causes, in the writer's opinion, operate in reducing the supply in moorland reservoirs, viz.:—scarcity of rainfall, and too little storage to impound the flood-water in wet seasons.

The distribution of rain is beyond the control of man, but the requisite amount of storage necessary to provide, *is* in his hands. Storage should be based on the number of acres drained, and on available rainfall. No well defined rules have been adopted, by waterworks engineers, to proportion the amount of storage relatively to the annual rainfall, and extent of drainage area, consequently many towns suffer a scarcity of supply shortly after a spell of fine weather sets in. When insufficient storage exists, waste of water, for industrial

purposes, takes place. Floods benefit no one beyond scouring the rivers which ought not to be polluted.

Every city and town in England should be compelled to utilize the resources of its water supply, and where such resources exceed the limits of domestic consumption the excess should be retained for the use of neighbouring bodies requiring water. This plan would insure the provision of ample storage and prevent the appropriation of watersheds too large for the requirements of a town, and flood loss in the main would be avoided.

The disparity in the storage of water is illustrated in the following table:—

Place.	Gallons stored per acre.	People supplied per acre of drainage.	Storage capacity of reservoirs in gallons.
Manchester	311,191	57·0	6,006,000,000
Bradford	117,215	11·1	4,732,000,000
Sheffield	234,796	27·1	3,687,000,000
Oldham	442,058	49·9	1,976,000,000
Bolton	347,970	82·1	1,157,000,000
Halifax	269,200	45·0	1,346,000,000
Wakefield	298,860	51·1	818,000,000
Blackburn	68,333	21·7	410,000,000
Swansea	206,785	44·4	512,000,000
Rochdale...	255,417	41·7	613,000,000
Batley	144,645	19·0	231,000,000
Plymouth	122,574	20·0	657,000,000

The trade, habits of the people, and physical features of a town vary, but not, one would think, to the extent the figures above indicate. The disparity shows the necessity of some action being taken to place the water supply on a more serviceable basis, in order that the watersheds of the nation shall be more thoroughly utilized.

Any shortage of water at the present time is in a measure owing to what appears to the writer a falling off in the amount of available rainfall during the past five years. The amount, however, does not appear much below the average, but it is sufficient to tell in places where the storage is insufficient, and the compensation too great. Much depends how and when the rain falls to make it serviceable for the works.

The reservoirs are always replenished when a fair amount of rain falls in a short time, but not when it falls intermittently with pauses of sunny gleams and dry winds.

Floods do not occur many times in a year, and unless they are collected at the time the water cannot be recovered.

During the past five years the writer has not seen more than an average moorland flood except on two occasions, and neither reached the dignity of a maximum flood.

Whether or not we are passing through a cycle of dry years it is difficult to

say, but all works should be made sufficiently large to meet every possible contingency, even at the cost of providing excess or overflow reservoirs. Water does not deteriorate with keeping, and is always obedient to the will of man.

The writer is convinced that the water supply of the country would be better in the hands of central bodies such as the County Councils. They could fix rain gauges to preside over the watersheds of their respective counties, gauge the rivers, and thus obtain the two sides of the rainfall equation so essential to a true knowledge of what a district is capable of producing, it would not then be left to men who have no knowledge of the work, and are interested only within the limits of their own circumscribed area.

SEWAGE DISPOSAL AND THE QUALITIES ESSENTIAL IN A SEWAGE EFFLUENT.

By GEORGE REID, M.D., D.P.H.,

Medical Officer of Health, Staffordshire County Council.

(Fellow.)

Read at Sessional Meeting, March 11th, 1903.

IN introducing the subject for discussion this evening, I wish, in the first place, to state the reason which led me to suggest that one of the Sessional meetings might usefully be devoted to a consideration of the question of the extent to which authorities may reasonably be called upon to go in the matter of sewage disposal.

From time to time attempts have been made to arrive at what might generally be accepted by experts, if not defined by law, as a uniform standard of purity for sewage effluents, but, so far, these efforts have been fruitless. Personally, for reasons which I need not trouble you with on this occasion, I cannot say I am disappointed that the attempt did prove unsuccessful.

Notwithstanding difference of opinion, however, regarding the wisdom of establishing a uniform standard of purity, hitherto experts have not differed as to the minimum essentials in a good effluent, and I think it may be said that the progress which has been made of recent years in the direction of simplifying the means by which the end in view may be attained has been little short of phenomenal.

The object we have striven to arrive at hitherto has been the production of a non-putrefactive effluent containing practically no matters in suspension, one which is non-destructive to fish life and has, in itself, sufficient available oxygen to mineralise, through the action of the nitrifying organisms present in it and in the stream into which it is

discharged, any dissolved organic matter still remaining unconverted. This is the minimum, but in certain cases—for example in Staffordshire, where, in the populous places, the volume of sewage to be disposed of exceeds the volume of the streams—we endeavour to carry the nitrifying process further, in order to have a reserve of available oxygen in the effluent for the conversion, as far as possible, of polluting matter which, of necessity, reaches the streams, beyond that which is contained in the sewage actually submitted to treatment.

But, gentlemen, in the light of recent events are we, I would ask, still as confident that we know what is, or rather what may be, required of us, and can we any longer congratulate ourselves on having arrived at something like a solution of our difficulties? Are there not indications that, after all, we have not fully realized our responsibilities, and that in future we may be called upon to accomplish a great deal more than has hitherto even been dreamed of by the most exacting enthusiast on the subject?

It was the hope that we might find an answer to this question which led me to suggest to the Council of the Institute that an evening might, with advantage, be devoted to its consideration.

Some five years ago, in view of the enthusiasm with which the introduction of modern biological methods was being advocated, a Royal Commission was appointed to enquire into the whole subject, and after three years' work an interim report was presented, for which those of us who, like myself, had for years been struggling to bring about much needed reform in the methods of disposal in operation, were thankful; for at last the fact was authoritatively recognised that land treatment was not an essential element in sewage disposal, and that authorities need no longer be called upon, as many had been previously called upon, to perform impossibilities.

Meanwhile, between the appointment of the Commission and the publication of their first Report, further practical experience of the working of biological plants strengthened still more our faith in the system, and we continued to assure authorities that they might unhesitatingly proceed to carry out improvement works on the new lines.

At the same time, while experience carried us thus far, opinions were by no means undivided as to the details to be observed in the construction and working of biological plants in order to obtain the best results, and we looked to the further work of the Commission to throw light upon some at least of the debatable points. In the Autumn of last year the Commission published a second Report, and I well remember the keenness with which I glanced through its contents, and the disappointment I experienced

on finding that it contained no reference to the questions of practical interest which we were hoping the Commission would elucidate. Undoubtedly, this Report contains matter of a most interesting character, which has some bearing, it is true, upon the question of sewage disposal, but I venture to suggest that at least five-sixths of the matter has a far more direct bearing upon other public health problems than the one which led to the Commission's appointment.

It is unnecessary for our present purpose, even if time permitted, to refer to the Report in detail. You are all aware that it consists of a series of reports by able bacteriologists, the outcome of special work conducted for the Commission, and with the exception of a short summary of the Report on the well-known Manchester experiments, with comments, the entire volume has reference to the quality of effluents, from land and from bacterial disposal works, as regards the presence or absence of pathogenic or allied organisms.

Now if we had reason to suppose that the Commission intended that the Report should be accepted simply as a record of scientific work for the information of health officers generally, well and good, but from the general trend of the questions put to witnesses by the Commissioners, and from the fact that in the Report itself the results of the working of experimental filters for the removal of bacteria from final sewage effluents are actually set forth, I am afraid that the Commission may ultimately recommend that, in certain cases, if not in every case, the process of purification should include the freeing of the effluents from organisms before their final discharge from the disposal works. At any rate, whether this anticipation be warranted or not, the publication of the Report has already resulted in its being gravely suggested by well-known public health specialists that, in addition to the purification process proper, if I may so term it, sewage should undergo a final process of water filtration before being discharged into a stream. Indeed, one well-known bacteriologist and lecturer on public health has gone so far as to say that if no other means will suffice sewage effluents must be boiled.

Now if such opinions can even be hinted at, I venture to suggest that it behoves those of us who are daily engaged in endeavouring to simplify a very difficult question, involving an expenditure which in some cases, even now, is little short of prohibitive, to take the bull by the horns, without waiting for any suggestions which the Commission may or may not make, and state very plainly what our views are on the subject.

In order to show that my apprehension is not groundless, let me refer very shortly to certain paragraphs in the Report itself.

Dr. Houston, who conducted a large number of experiments for the Commission as to the bacteriological qualities of effluents from various methods of sewage treatment, says:—"The effluents from septic tanks, intermittent contact beds, continuous filtration beds, etc., contain an enormous number of bacteria. . . . In not a few cases the bacteria are practically as numerous in the effluent as in the raw sewage." Further, he states that "the inoculation of animals with the effluents from bacterial beds seems to show that they are nearly as pathogenic as crude sewage."

As regards land treatment, he says, "the treatment of sewage on land, although, perhaps, more satisfactory from the bacteriological point of view than its treatment in bacterial beds, would not seem to by any means entirely remove the danger arising from the discharge of effluents into potable rivers."

As regards effluents from chemical processes of treatment, the Report states that it may be found to be the case that the addition of chemicals may be carried to a point sufficient to destroy pathogenic organisms without rendering the sewage insusceptible to subsequent purification by bacterial means, but that before this point can be settled much experimental work must be carried out.

As regards the question of standards, Dr. Houston says that "a bacteriological standard in the case of drinking-water streams is certainly called for, and, indeed, is far more important than a chemical one," but that a chemical standard should also be imposed.

In the case of non-drinking-water streams, he says, "except where oysters and other shell-fish, which are eaten raw, are concerned, the bacteriological character of an effluent is of secondary importance." He qualifies this opinion in a foot-note, however, in the case of sewages which may contain anthrax spores.

In discussing the ways and means of rendering a potentially dangerous effluent actually or relatively harmless, Dr. Houston refers to fine filtration and the addition of chemicals as two alternatives. As regards the former, he says that "presumably it would cost as much to satisfactorily filter the sewage effluent of a town as it would cost to filter the water-supply of the same town." Probably we may infer from this that Dr. Houston contemplates the filtration of the dry weather flow only, but as regards this I shall have more to say later.

As regards sterilization by chemicals, it is suggested that the process need not be carried further than the destruction of Bacillus Coli, on the ground that if carried thus far it would probably mean the destruction

also of the typhoid bacillus and the germs of epidemic disease generally. The cost of such partial sterilization, it is said, would not be out of proportion to the "enormous gain in securing comparative immunity from danger," and there are, it is stated, many substances which probably would answer the purpose, such as ozone and chlorine compounds, the most suitable of which could be definitely settled by further experiments. Here again one may infer that Dr. Houston had in his mind the sterilization of the dry weather flow of sewage only, although, later on in the Report, when dealing with the pathogenic qualities of sewage and effluents, he gives examples of street washings and discharges from storm overflows, even after a flow of four hours, proving fatal when injected into guinea-pigs.

The Report also contains an account of numerous experiments by Prof. Boyce and others as to the effect of fine filtration in removing bacteria from effluents. A further large section of the Report sets forth the observations of Prof. Boyce and others on the self-purification of the river Severn below Shrewsbury from a bacteriological point of view. I do not propose to refer to that part of the Report, however, beyond quoting the concluding paragraph, as showing how unimportant in the eyes of the expert advisers of the Commission is the purification of sewage as we understand it, compared with the requirements of their biological standards. The paragraph reads as follows:—"Shrewsbury with 29,000 inhabitants, and turning crude sewage into the Severn, causes an average pollution of 600 B. coli communis per c.c. (at the point of maximum pollution), and this is felt 16 miles lower down. But if a large town like Leeds were similarly situated, and the sewage were purified by contact beds so as to contain 10,000 B. coli communis per c.c., the pollution would still be about 1,000 B. coli communis per c.c., and if 600 B. coli communis are felt for 16 miles, 1,000 would be felt still further down. Consequently, in spite of the artificial purification, such a river would be in a worse condition than the Severn at Shrewsbury, which is admittedly bad. It follows that the purification thus attained would be insufficient, and that some further treatment would still be necessary."

The inference to be drawn from the above is, that less injury would result from the discharge into a stream of the crude sewage of 29,000 people than from the discharge of the treated, therefore, non-putrefactive sewage of a population of 420,000 odd. All I can say is, that if I were given the choice it would not be the crude sewage of 29,000 people which I should select in the case of a stream over which I had control as an alternative to the treated sewage of a population, no matter how large.

Beyond mere casual mention, the alleged injury to the public from the

discharge of a non-bacteria free effluent into a stream is not discussed in the Report. I gather from Dr. Houston's section of the Report, however, that the following are his reasons for advocating either the sterilization or the filtration of sewage effluents :—

1. The risk of typhoid or cholera (if not of epidemic diarrhœa as suggested by Prof. Boyce) in the event of water being drawn from the stream for a public supply.

2. A similar risk to individuals who may casually drink such river water, or use it for washing utensils, or who may bathe in it.

3. Injury to cattle.

4. The contamination of shell-fish.

Let us consider these propositions seriatim.

In the first place, we are all agreed, I imagine, that there is real risk in taking a public water-supply from a stream into which a sewage effluent has been discharged. This being the case, it follows that steps must be taken to safeguard the public against such risk, and the question is by whom are such steps to be taken?

Let us suppose that this duty is imposed upon the sewage disposal authority. In such an event it is perfectly obvious that to provide a water purifying plant for the dry weather flow of sewage only would be quite useless, for, during storm periods, an enormously increased volume of sewage would be discharged into the stream, every gallon of which would have to be similarly dealt with. At present, according to the Local Government Board's requirements, a sewage disposal plant must be capable of fully treating a volume of sewage equal to three times the dry weather flow, and, less fully, a further equal volume, bringing the total volume treated up to six times the dry weather flow. This may be all very well so far as sewage purification, as we regard it, is concerned, but, from a bacteriological point of view, a discharge from sewer storm overflows greatly in excess of this would have to be provided for, if the sewage disposal authority is to be held responsible for a bacteriologically pure effluent. For the sake of argument, however, let us limit the volume to six times the dry weather flow in order to arrive at the probable minimum cost of a sewage disposal plant on such lines.

I believe that a reasonable amount to allow for a sewage disposal plant is about 15s. per head of the population, and I am told that water-filters cost from 2s. 6d. to 3s. per head. The latter figures, however, are based upon a consumption of 25 gallons per head, whereas, as I have said, at least six times that volume would have to be the basis in the case of the sewage effluent water-filter plant, so that the actual cost per head of such a plant, basing

the estimate on the smaller figure named, would amount to 15s. per head. In other words, the addition of the extra plant would exactly double the capital cost of sewage disposal works and, of course, add considerably to the working expenses. But in the vast majority of cases even this large additional expenditure would not cover the cost, for, as a rule, by the time sewage has been treated, the fall then available will not allow of the adoption of a further filtration process, so that pumping would have to be resorted to, with its attendant large capital outlay and greatly increased maintenance expenditure.

The alternative to filtration, according to the experts of the Commission, is chemical sterilization, but at present they are not in a position to suggest any specific method. We may take it, however, that no matter what chemical method be suggested the cost would be very great, besides, it is questionable whether certain risks which would attend such a proceeding could be effectively guarded against. But, gentlemen, I would ask, in the event of this onerous duty being imposed on the sewage disposal authority, would the water authority then be relieved of the responsibility of filtering the stream water? and if the answer, as undoubtedly would be the case, should be in the negative, I would further ask, then why go to such enormous expense seeing that the necessity for subsequent filtration of the water is not thereby done away with? Perhaps the answer to this last question is to be found in the other risks mentioned by the bacteriological experts, namely, the casual use of river water for drinking purposes and for utensil washing. My answer then would be that it is the duty of every sanitary authority to see that every household is provided with a satisfactory water-supply, and if certain misguided people should think fit to run the risk of using dangerous river water for domestic purposes they must take the consequences. The same holds good in the case of bathing, as authorities have the power to provide public baths, and if a clean river is available, places may be specially set apart for public bathing.

As regards cattle drinking, it is by no means established that animals do suffer from drinking river water which is polluted even by crude sewage, and I know of no instance in which injury has resulted in the case of streams which receive properly purified effluents according to our present ideas of purification. Be this as it may, however, streams are the natural and only outlets for the sewage of the population, therefore no private interest should be made the pretext for imposing conditions upon authorities in the direction of sewage purification beyond such as are reasonable.

In regard to food supplies, such as shell-fish and watercress, the danger is undoubtedly real, as recent events have amply demonstrated, and no doubt we are all agreed that a remedy is called for; we are probably also agreed, although the general public do not yet appreciate the fact, that no matter how perfect the system of sewage disposal adopted may be, the effluent, by reason of the organisms it still contains, must prove dangerous if shell-fish reared in creeks and rivers into which it is discharged are allowed to be placed on the market. Here again then is an example of private interests being advanced in opposition to public necessity by an attempt to impose upon authorities restrictions and conditions which cannot by any reasonably available means be observed or complied with.

What then is to be the remedy in this case, for a remedy must be found? I venture to suggest that the only solution of the difficulty is the closure of all oyster culture beds situated near the natural outlets for sewage or sewage effluents, and removal of the beds to positions of safety which shall be licensed for the purpose by sanitary authorities of not too decentralised areas.

Now I hope it will not be supposed from what I have said that I wish to discredit any attempt to free our drinking-water streams, as far as possible, from dangerous sewage organisms; all I maintain is, that in the light of our present knowledge, by no conceivable process can this be accomplished at sewage outfall works. It does not follow, however, that another way out of the difficulty may not be found, and the remedy, in my opinion, both on scientific and practical grounds, should be applied at an earlier stage, and should be directed against the introduction into the sewage of disease organisms. To say this, I am aware, is to enunciate a very elementary principle in public health administration, nevertheless, it is a principle which in practice is, I fear, too often forgotten, or, if remembered, is carried out in a manner which affords little or no chance of its purpose being accomplished. Only a small minority of typhoid fever patients, taking the country as a whole, are at present treated in hospital (in Staffordshire the percentage is only 9·6, and I have no reason to suppose that it is much higher in other counties), and it is hopeless to expect that instructions as to the disinfection of excreta will be efficiently carried out by the inexperienced persons in charge of the home cases. The Local Government Board and County Councils should, I maintain, rigorously exercise their powers, not only to compel the provision of hospital accommodation for the treatment of typhoid cases, but also to ensure, as far as possible, that all cases occurring in families, who cannot

afford the luxury of skilled professional nursing at home, shall be treated in such hospitals, where the thorough disinfection of all excreta before their discharge into the drains could be ensured, and thus the remedy sought for would be secured at one-hundredth part of the cost which fruitless attempts later on would entail. The tendency of the Bacillus Typhosus is to diminish, not to increase, in sewage, and, that being the case, the injury which might result from the discharge of infected excreta from unrecognized cases, and from cases which may escape the vigilance of the authority's officers, would be comparatively unimportant.

With the exception of cholera, which of course would be dealt with similarly, the only other specific disease the cause of which is now being attributed to intestinal organisms is epidemic diarrhœa, but, so far as I am aware, it has not been suggested that the vehicle in this case is drinking-water.

Gentlemen, I hope I have said nothing which may appear to indicate a wish on my part to discredit the laborious work of the expert advisers of the Commission; my sole desire in commenting upon the second Report of the Commission has been to direct attention to the situation from its practical aspect, that is from the point of view of those who are the responsible advisers of authorities on a matter which is already sufficiently complicated and difficult. Authorities complain, not without reason in many cases I fear, that upon the advice of recognised experts vast sums have been spent upon works which have proved to be failures, and one is not surprised at being asked by those who, under strong pressure, are now spending further large sums in correcting past blunders, what guarantee we can give that in the course of a few years we will not again ask them to put their hands in their pockets? Before we submit to being placed in this position, the inadequacy, from a health point of view, of the present methods must be established beyond a doubt, and this I maintain has not yet been done.

The Chairman (Colonel T. Walter Harding) said they would quite appreciate that he was not quite free to speak on this subject, being a member of the Royal Commission which has not yet fully reported, and in the present state of their investigations it would be unwise for him to frankly express his own views, and still more unwise would it be to try to express the views of any of his colleagues. He might, say, however, that he was in entire agreement with Dr. Reid in what he said about sewage effluents, that it was not so much their chemical or their present condition, but the future of the effluent that was important, namely, whether there would be subsequent putrefaction, or whether the effluent

contained within itself elements of further purification which would ultimately deal with organic matters remaining. He thought Dr. Reid had been raising a bogey, not of the Royal Commission, but a bogey of his own imagination. Dr. Reid had spoken about the second Report of the Royal Commission, but anyone who had looked at that document would see that it was a mere formal report of two or three lines, covering some scientific reports made to the Commission. Those reports are not reports of the Commission, but they are reports to the Commission, and they do not bind the Commission. It will be, of course, the duty of the Commission to give to these very interesting reports of the experts the careful attention which the names of their authors deserve, but it would be also obviously the duty of the Royal Commission to consider other matters, and among those would be the very important question as to what is reasonable and what is practical from the point of view of expenditure. No one was more keenly alive than himself to the greatness of the burdens which now rest upon ratepayers, the difficulties that lie before the authorities. He was intimately associated with the carrying out of this great problem of sewage purification in a great manufacturing town, the normal flow of which was about 20 million gallons a day. And if, as was suggested, it would be necessary for them ultimately to deal with six dilutions, or 120 million gallons a day, they might rest assured that he, for one, would not be likely to recommend such a course as that which, Dr. Reid said, some one had proposed, namely, the boiling and evaporation of a great volume of that kind. Although he would ask them to accept the reports of the eminent experts he had named as not the reports of the Commission, and not binding the Commission in any way, yet he did feel that these reports were very valuable, and that they had called attention to a point which had not been sufficiently looked into, namely, that in considering the quality of an effluent we are bound to look beyond mere chemical analysis and chemical standards. The question of bacterial standards had hitherto been very little dealt with, and it was evident that by some processes of sewage treatment there did remain in the effluents considerable quantities of bacteria. It might be that the greater part of those bacteria were quite innocuous, and the only reason why B. coli was taken was not because B. coli was necessarily pathogenic or objectionable, but because the number of B. coli was a measure of the remaining impurity in the effluent. If there was a great quantity of B. coli per c.c., the probability was that the purification had not been carried far enough, and that with B. coli may be found the true pathogenic bacteria. Time was when people simply went by the appearance of an effluent. If an effluent were clear and the solids had settled, that was thought in the old days to be a really satisfactory effluent; but their ideas had advanced since then, although he would remind them that the appearance of an effluent channel still had certain characteristics to the sight which were very valuable. There could be seen on the walls of the channels, indications of the reduction of impurity which has been reached in the treatment. Certain grey, black, and dark-brown growths are to be found in the channels which convey impure effluent, as for instance

the effluents from septic tanks ; on the other hand, where green growths arise, it is usual to find that considerable purification has been obtained. Therefore, the test of the eye is one which must also be taken into account. Then there is the chemical analysis, and they must also take into consideration the bacteriological conditions. Other things being equal, if one process promises to eliminate without additional cost, the great quantity of bacteria which are usually found in effluents, it may be wise to adopt that, but the whole matter is still in an uncertain condition. He would ask them to have some patience in waiting some time longer for the report on land treatment, and on the treatment by artifically prepared areas, and to wait with patience, because the longer it is delayed within reason, the more valuable will that report be. Nothing had impressed him more in the study of this question than that in order to find the value of a particular method of treatment it is necessary to watch it for a considerable time. There are many processes, to which attention had been called, which appear to be extremely promising, but it is only at the end of a year or two that their defects are apparent.

Prof. Henry Robinson (London), in opening the discussion, said that as one constantly engaged in dealing with sewage questions professionally it behoved him to be extremely careful how he expressed opinions, and not to prophesy. He thoroughly agreed, however, there was a great feeling of disappointment—and he said this with regret in the presence of the Chairman—that much of the information which had been obtained by the Commission did not bear directly upon what engineers and local authorities had been looking forward to for so long. He thought that a large amount of the data (Dr. Reid said five-sixths) which had been collected by the Royal Commission referred to matters other than those on which they were looking for information. That was somewhat discouraging, and he expressed the hope that further investigations conducted by the Royal Commission may be directed more to the solution of some of the problems which concerned all those who had to advise on the sewage question. He could, however, say that the interim report contained one or two paragraphs which did slightly help, and sewage engineers were thankful for small mercies. The report contained the information that clay land and peat land were not suitable for sewage disposal purposes. They all knew that before, but this confirmed their opinions. He remembered on one occasion trying to induce an inspector of the Local Government Board to permit him to deal with the sewage of more than 1,000 people to the acre (after previous treatment bacterially) on splendid porous land, which would take a very much larger amount of sewage effluent than the prescribed proportion. The text of the Local Government Board was quoted that there must be an acre of land for the treatment of the effluent for every thousand people ; and the learned counsel who was acting with him in the case jocularly remarked that evidently the Local Government Board regarded an acre of ducks' backs as similar in all respects to an acre of paving stones or gravel. Now, what the Commission had

done had enabled the Local Government Board to vary its conditions in regard to land, and to give engineers a freer hand. This was attended with the difficulty that Local Government Board Inspectors had more responsibility thrown upon them as to judging the conditions of each case, whereas the previous simple rule did not require any detailed investigation for its application. He would only deal with the biological system of treating sewage to the extent of referring to what he had often stated in public, that the "Contact Bed" system —which may be described as the filling, emptying, and resting of a volume of sewage in a tank containing material with interstices—is not the best way to utilize the functions of aërobes and anaërobes. Many bacteriologists are of opinion that anaërobic action is interfered with by an admission of air during the time the "Contact Bed" is empty; and, on the other hand, that aërobic action is equally affected by the cessation of the supply of air. This had led him to speak in favour of what he had called the trickling system (which he had employed often), namely, that the impure liquid should be constantly in the presence of air under conditions favourable to the aërobic germs developing their functions to the utmost. From the common sense point of view this seemed to be the right system, and many bacteriological experts had expressed agreement with his views. If he was right, many towns were now expending money on a system which was open to this doubt. The alternative method, which he had referred to, and he had adopted in his own practice, involved much less capital outlay, and at the same time gave better results.

PROF. A. BOSTOCK HILL (Birmingham) imagined that the question of the treatment of sewage or types of filters was not raised by the paper, the purpose of which, he took it, was to enter a protest against the idea, which was apparently gaining ground—perhaps not in the mind of the Royal Commission, but in the minds of the experts who had been advising that Commission—that certain things would be necessary. He did not think Dr. Reid's paper raised a bogey in regard to the Commission, but rather as to the results of the work of the experts appointed by that Commission. If that was the meaning of the paper, then they were all much indebted to Dr. Reid. Personally he thought some protest, temperately expressed, based on the result of experience, as well as on bacterial knowledge, was very important at the present time. County medical officers of health had as one of the most important of their functions that of dealing with the pollution of rivers, and they knew how difficult it was to move local authorities at the present time properly to discharge their responsibilities. If one had to suggest to these local authorities works involving enormous expenditure and of unproved value in addition to the ordinary methods of purification, *i.e.*, up-to-date methods of purification, he was afraid the cleansing of rivers would be put back much further than seems likely at the present time. The question also arose as to the necessity of these very vigorous measures. On only one point could he throw light and that was the question of cattle drinking effluents. He had been engaged in many cases where actions at law had been fought in regard to the poisoning of cattle

by discharging an impure effluent into the streams to which they had access. He had never known a case where an effluent properly oxidised—what could be called chemically a good effluent—had had that effect upon cattle. He had known cases, however, where cattle frequently died on account of the sewage of a city gaining access to the river, but with a proper bacterial treatment and production of an excellent effluent, no death of, or injury to, cattle had occurred for five or six years. This fact showed that a bacterial effluent, a proper bacterial effluent highly oxidised, is not, as far as we can judge, dangerous to cattle in any degree. The point, however, is this—are they as purifiers of sewage to double their labour and expense in making effluents sterile, while if any of it is to be used for the purpose of drinking water afterwards, it has again to be rendered sterile? He thought that the duty of sending the water supply to the consumer in a proper state should be laid upon the shoulders of the company, or those who supplied the water. He believed it to be absolutely impossible to sterilise effluents by heat, because, if this could be done in time of ordinary dry weather-flow, it would be impossible to achieve it during time of storm, particularly under certain conditions when storm overflows discharge into streams with even a comparatively small increase of the rainfall. To attempt any such system, therefore, would be to produce a false sense of security after enormous expenditure, and, as every such system would be liable to break down continually, the final result achieved would be no more satisfactory in the end than if the works had not been undertaken.

Mr. H. A. Roechling (London) said there was a note of very keen disappointment throughout the whole paper, and that note appeared to be based on the way in which Dr. Reid viewed the conclusions of the Royal Commission. Those views seemed to be based on a misconception. To all those who had previously expressed decided views against the land treatment and had fondly clung to the hope that in the artificial processes there was to be found a panacea for all sewage troubles, the reports of the Royal Commission must, to some extent, be disappointing. Those, however, who did not hold such views, or who had studied the question afresh in the light of the very valuable evidence produced by the Royal Commission, would feel that they owed a debt of gratitude to the Commissioners for the very painstaking way in which they had gone into the question, and the very interesting material they had produced. Dr. Reid had said that the first report officially recognised that land formed no essential element in sewage treatment. He had looked into the report, but had been unable to discover a justification for this statement, and he thought this was one of the misconceptions under which Dr. Reid laboured. Having quoted from the report as to the views of the Commission that clay and heavy peat land were generally unsuitable, but that they doubted if any land was entirely useless, he said in this connection he would point out that at Leicester, with a large population, they had successfully coped with their sewage for nine years on the densest clay land possible,—on land that was thought to be perfectly impervious.

Dr. Houston, in his report to the Commission, also stated that it appeared possible that land of proper quality, and with efficient management, would produce remarkably good bacteriological results; and Prof. Boyce said it was evident that either land or any other method of efficient artificial filtration must totally remove B. typhosus if it happened to be present in an effluent. This then was the conclusion of observers: that land had the power of removing pathogenic germs. He had examined all the records, but could not find any authentic case where sewage farms had produced typhoid fever or had spread it. In this connection he pointed to one of the sewage farms of Paris, where the effluent had been drunk for many years without any apparent injury to health, in preference to other sources of supply. The late Monsieur Pasteur took a view against sewage farms, but learning of the excellent results obtained in Berlin withdrew his opposition. It was perfectly true Dr. Houston had said in his report that in some cases of land treatment the effluents did not come up to the standard of bacterial purity previously mentioned, but that did not prove that land had not the power of removing pathogenic germs, but only that in certain cases the manner of treating sewage on land left something to be desired. It had not been proved that the principle was wrong, but only that the application of the principle in a particular case was not efficient. Having referred to the findings of the Royal Commission as regards the artificial methods, he said that it concluded it was possible by artificial methods alone to produce an effluent that would, according to chemical standards, be considered good, and that there were cases in which the Local Government Board would be justified in modifying under proper safeguards the existing rule as regards land. It was to be observed that the Commissioners limited their remarks in the first instance to some special cases, and secondly, that in these special cases the present rule as to land might, under special safeguards, be modified. They did not say that in every case where artificial methods were employed, land could be abandoned altogether, they only went so far that in some special cases the present rule as to land might, under proper safeguards, be modified. This was the misconception under which Dr. Reid seemed to labour, and the conclusion of the Commissioners was perfectly clear on this point. They did not hold out any hope that they would reverse this conclusion. The question they were apparently now considering was as regards the safeguards, and he imagined that this was the point which required elucidation. From this point of view the second report of the Royal Commission was an uncommonly valuable one, and placed before the public facts which previously had not been before them in that form. This report should be carefully studied, and he took it that this was the Chairman's view of the reason why it was presented to the Commission. Referring to the question of pathogenic germs in effluents, he assumed that if it was necessary to purify sewage at all, it was necessary to remove from it its most dangerous constituents, which were pathogenic germs. If treated sewage had left in it, its most poisonous elements, could it not be urged against them afterwards that they had acted against common sense! When the old standards were formed there had been no

direct means in existence of ascertaining the micro-organic life in sewage; now, however, they had a direct method, and it was their duty to employ it, but he regretted that Dr. Reid had not given them any indication or any advice as to how these pathogenic germs could be got rid of. According to Dr. Reid's paper the duty of removing these pathogenic germs ought not to lie with the offending party, but with the offended or injured party. As a matter of pure equity this contention would not hold good for five minutes, it being one of the fundamental principles of English law that the offending party shall suffer for its offence, and not the injured and innocent party. The suggestions contained in the lecture seemed to be very cold comfort, especially when it was said that any misguided person who happened to drink some polluted water must take the consequences of his action. He agreed in theory with the author as to the exclusion of pathogenic germs from sewers, but in practice it would take many years before the measures recommended by the author would result in such a reduction of pathogenic germs that they could be admitted into our rivers. The advice given by the author amounted to this: "Do nothing yourselves, but compel others to do your work," but this advice, he did not think, would appeal very strongly to many of those present. Had the author taken more notice of land treatment, and had he not read into the reports something which they did not contain, he believed the author would have ended by blessing instead of cursing the Royal Commission. It would, he said, be found hereafter that land had been greatly abused in this country, not because the land itself was at fault, but because the management of the land had been at fault. Land had the power of removing pathogenic germs, and of rendering the effluent harmless, and he saw no reason why we should not avail ourselves, when possible, to the very largest extent of this method of treatment. In fact, who of those present could say that the Local Government Board, in persisting on land treatment as a final treatment of the effluent, had not in many cases stood between the locality and an epidemic?

Mr. W. D. Scott-Moncrieff (London) observed that the discussion turned upon the point as to whether Dr. Reid had been altogether justified in the course he had taken in bringing this particular point before the Sessional Meeting of the Institute. He sympathised with Dr. Reid, and agreed with him that the facts quite justified the course he had taken, and he thought the paper had proved that the author had a good case. Some of the gentlemen who had spoken had forgotten one or two facts as to how far public opinion was misled by the action of the Royal Commission, who were responsible for the report of the experts. He would point out, for instance, that in a recent report to the London County Council in regard to the experiments going on at Barking, it was deliberately stated by the Chairman, in deference to the report of the experts, that there was a large number of pathogenic germs in the effluent obtained in the experiments at Barking, therefore it was unnecessary and inadvisable to go further into the matter. That was a distinct misguidance of public opinion on a very important point, and all the more so when it is considered that the

County Council of London are putting about 50,000 tons of sludge into the estuary of the Thames per week, a proceeding which is associated in the minds of many people with the pollution of shell-fish. This misguidance arose directly from the line that has been taken by the Royal Commission, and more especially by the elaborate reports of the experts. Under these circumstances Dr. Reid was fully justified in bringing the matter before the Institute, and he was to be congratulated in having stated his case in an exceedingly moderate and reasonable manner. What the paper claimed was that the Royal Commission should not go out of its way to make it more difficult for those who already have got a very heavy burden to bear in dealing with the question of rendering sewage effluents innocuous. He ventured to suggest that the Royal Commission were venturing upon dangerous ground. The Chairman had suggested that Dr. Reid had raised a bogey, but Dr. Reid's fears were reasonable considering the tendency of the totally unguided labours of the expensive and highly trained experts. The dangerous ground on which the Commission is treading is simply this—how far are you going to alarm the public with regard to the drinking water of such a community as London? If the standard was to be raised to the deep well standard, or if they were to raise the standard to that of water coming from unpolluted areas, then those standards in the case of rivers like the Thames would be perfectly impracticable. It could not be applied to a river like the Thames which during parts of the year is always more or less in flood, the water being saturated with pathogenic and other organisms due to surface pollution from highly manured arable land. They would see that these standards are impossible, and that it is very dangerous to raise such a question, especially at a time like the present when the problem of the purchase of the water companies' properties is pending. Complaint would be hereafter made that the companies were paid ten times too much for their property, considering that it had been already condemned by the Royal Commission as to the sources from which their water is taken. He was pleased therefore that the Chairman had spoken, of course with all reserve due to his position as a member of the Commission, and stated clearly that Dr. Reid has taken a somewhat exaggerated view. In other words, he imagined that the Royal Commission did not mean the public interested in this question of sewage purification to take their interim report too seriously, alarming people as it did by raising the question of too high a standard as regards pathogenic organisms. Everyone, he was sure, was waiting most anxiously for the report of the Royal Commission which has been so long delayed. It was to be hoped that this report will give some definite indications as to what the views of the Commission are, as to the way in which a first-rate effluent up to modern standards may be obtained without discussing the question as to whether it may contain a certain number of pathogenic organisms which in the nature of things must exist, whether the pollution is direct from the sewage or from arable land, or from both combined. The question of preserving uncontaminated streams or sources of supply from pathogenic organisms was of course quite different from the one which Dr. Reid had dealt with in his paper. He

did not think Dr. Reid with his great experience would have suggested the prevention of pollution from each individual typhoid patient, unless he knew it was at least more practicable than making drinking water of sewage effluents.

Mr. Gilbert Fowler (Manchester) said he thought on hearing Dr. Reid's paper that they would be practically unanimous in agreeing with, at any rate, most of his conclusions. Personally he was thankful that the Manchester Ship Canal was not a drinking-water stream, and he thought it was never likely to be, even if it was practicable to make it. He had considered the question of the partial sterilization of the dry weather flow, and had come to the conclusion that, while this might be attempted, it was absolutely hopeless to attempt to deal with the flow which occasionally comes down. The other day they measured at a rate of something like 200,000,000 gallons in 24 hours, and at the height of a storm-flow like that the refuse and contamination brought down from the street was in enormous quantities. He differed from Mr. Roechling in that respect because, while it was possible to filter the water supply for daily consumption, it was quite impossible to deal with such large quantities of the liquid as he had described. In Lancashire they had not as much land as they had in Leicestershire ; towns were close together in the Northern districts, and that circumstance constituted a real difficulty. He desired in a humble way to defend the Royal Commission from some of the attacks which had been made upon it—attacks which appeared to him to be unjustified. Some gentlemen appeared to forget that it was not possible to carry out large experiments connected with sewage treatment, as well as such investigations as had already been reported, without some delay. It would be within the knowledge of many that the Royal Commission were keeping careful watch over a number of works in the country where sewage was efficiently purified in larger and smaller quantities. In their own case at Manchester they sent up periodical reports, and this was the case elsewhere. The important point in sewage purification was the question of time. He believed if they exercised their patience a little longer, the time so occupied would be fully justified. The essence of the success or failure of modern experiments depended on how long they could be carried on without serious expense—without renewals of one kind or other. Such information can only be obtained after a number of years. The Massachusetts experiments have been going on for upwards of ten years, and the older the installation grows, the more interesting and valuable are the results obtained. As it was, it had been of the utmost value to have these detailed reports of the laborious work of the Royal Commission experts before them. Certainly those reports made very clear some points which were in danger of being forgotten, namely, that an effluent which was chemically above suspicion may contain a large amount of pathogenic organisms. Consequently the public, at any rate, were safeguarded against the use of such an effluent, either directly or for drinking or other purposes. At the same time he agreed practically with everything in Dr. Reid's paper, but thought it was necessary that the facts of the case should be carefully and well studied.

MR. DOUGLAS ARCHIBALD (London) said that while he sympathised with Dr. Reid in his desire to have some limits to the standard of purity, the author appeared to forget that the Royal Commission must investigate all the conditions of an effluent both from a chemical and bacteriological aspect. Ultimately, no doubt, the Commission will make up its mind as to how far the local authorities will be required to produce an effluent free from bacteria or not. Anyhow, Dr. Reid had raised a bogey which appeared to be of more simple solution than he apparently thought. For he believed that preliminary chemical treatment would be one of the best ways of sterilising an effluent after all. Prof. Frankland stated, before the Royal Commission, his opinion that in removing the solids, chemical precipitation properly carried out simultaneously removed a great proportion of the bacteria. It always seemed him to be one of the weaknesses of the bacterial system, that instead of allowing the solids to deposit at the bottom of the tank it tended to add them to the liquid by a process of solution. In that case, of course, a great deal of the suspended solids was carried into the filters, and as a consequence, as Dr. Houston said, effluents from bacterial works contained as many pathogenic germs as the original sewage. That was certainly not a desirable state of things. If by any means, such as the addition of chemicals, the solids could be left at the bottom of the tank, and then the effluent passed over a bacterial bed and purified to the requisite degree of chemical purification, which in some cases could be done in one filter, there would be great advantage. He knew of cases in which by the addition of adequate and proper chemicals, one filtration was quite sufficient to effect complete purification after tank precipitation. The solution of the problem would in such a case be rendered ideal where the solids thus precipitated were disposed of by sale, and he knew of one case where that was accomplished. No bacterial scheme he knew of disposed of the solids, but simply distributed them between the septic tank and the subsequent filters. Not more than 36 per cent. could be dissolved in a septic tank, $33\frac{1}{2}$ per cent. is left in the tank, and $30\frac{1}{2}$ per cent. goes on to the filters. Not only had the tank sludge to be got rid of, but also the sludge in the filters. It seemed to him that the proper line lay in a combination of the two systems. What was required was not only something that removes the sludge, but gave a chemically pure effluent, and one that is absolutely so far as we can make it, free from pathogenic organisms.

MR. SIDNEY R. LOWCOCK (Birmingham), observed that he had hoped the lecture would have been more interesting from an engineering point of view, but he was extremely glad to hear the chairman's opening remarks which indicated that authorities may be called upon to spend more on sewage disposal, in order to produce more satisfactory effluents, than they have at present. A very large proportion of the failures in this country were due entirely to a false idea of economy. The authorities would not spend enough to ensure success. Everything was sacrificed in the attempt to get all the sewage down to the outfall works by gravitation, and as a result an insufficient fall was obtained for the proper distribution and treatment of the sewage: and where land treatment was adopted the

low lying areas which could be commanded were insufficient in extent or water-logged, and very frequently the soil was of an unsuitable character. All these difficulties could be got over if they were not so unnecessarily afraid of incurring the small expense of pumping and other mechanical arrangements. He sympathized with the observations as to the mis-use of land, but then that was usually a question of cost too. Land was extremely uncertain in quality, but when engineers constructed filters they knew to a very large extent what the capacity for purification of any particular area and depth would be, and what the subsequent results were likely to be. Filters occupied much less space and could be kept under much better control than an unwieldy area of more or less suitable land. Mr. Roechling admits that the principles of purification are the same in both cases, but it appeared to the speaker that the comparison between them was much the same as between the old slow working engine at five pounds steam pressure and the modern high speed engine at 150 to 200 lbs. pressure. Although he did not believe it was necessary, he thought that in cases were land was available and could be obtained cheaply it would be advisable, from an economic point of view, to have it below the filters, so that when the filtered effluent could be usefully applied to the crops it could be turned on to the land and at other times direct into the river. He thought they ought to thank Dr. Reid very much for bringing this matter before them in the way he had. On one point Dr. Reid appeared to be coming round, and that was on the question of standards. Dr. Reid did not approve of a uniform standard, but he admitted that experts have agreed as to certain minimum essentials in an effluent. Well, if they agreed as to a minimum surely that is a standard in itself. From an engineering point of view he was in favour of a standard, because a standard simplifies operations so much. It is wiser for an engineer to aim at something high, and as a consequence he is likely to do much better than if he had no standards to guide him at all. The Mersey Board and the West Riding Rivers Board, and several other authorities, have practically agreed upon a standard, and there is not much difficulty. Prof. Robinson asked for someone to express their opinion as to the advisability of the trickling system, and he could say that he was very strongly of opinion that for the final treatment of an effluent a trickling filter is far away the best. He had been supporting this view for twelve or fourteen years, and was glad that people were coming round to his opinion.

Dr. Reid, in reply, said he was glad to hear the Chairman's remarks about the supposed bogey which had been raised in the paper, as we might conclude from that, that the Commission did not intend to recommend that sewage effluents should either be filtered or sterilised. If the experts who had been engaged by the Royal Commission had merely conducted experiments for the purpose of ascertaining the number of bacteria, pathogenic and otherwise, present in the effluents, well and good, but they had gone much further than that, as a large section of the Report was devoted to a description of experiments designed to show by what specific process of treatment these bacteria may be removed

from effluents. From this, surely, it was reasonable to infer that in the opinion of the Commissioners it was desirable to render effluents free from bacteria. Where then was the bogey which, according to the Chairman, he had raised. His point was that the bacteria obviously cannot by any practicable means be removed from the sewage or effluent at the outfall, and therefore, it was waste of time to conduct experiments to show how they could be removed. But the experts were not satisfied with having gone even thus far, as the Report also states that further experiments are desirable in order to see what can be done in the direction of sterilising effluents by other methods. He contended, therefore, that his criticism was justified, and that there was real cause for anxiety on the part of Authorities, who already have a sufficiently difficult problem to solve without the introduction of further and needless complications. He entirely agreed with Prof. Robinson's views on filtration, and it was many years since he deprecated the purification of sewage by "contact" beds. The difficulty hitherto had been to secure the even distribution of the sewage over the filter. but that difficulty is now, he believed, being overcome. In the future, no doubt, filtration would be the treatment, and "contact" would be a thing of the past, He was glad that Prof. Bostock Hill agreed that the person who distributes the water to the consumer should be the person responsible for its purity. In reference to the point raised by Mr. Roechling, the Commissioners certainly said in their first report that it was not essential for the purification of sewage that it should be applied to land. None could contradict that. They said that there are methods by which sewage can be disposed of without its application to land, hence, the Authorities in the country are now in a position to say to the Local Government Board, on the authority of the Commission, that land is not essential, and he was glad to think that the Local Government Board are acting upon that report in that respect in certain cases. No doubt the Commissioners' experts did say that land of a certain quality would produce a better effluent from a bacteriological point of view than artificial filters; but it was necessary to have that land of certain quality, and taking England all over could it be said that they could find land, even in the majority of cases, of such a quality as would effectually purify sewage and at the same time produce an effluent of bacterial purity? In Staffordshire they could not; there the land was largely clay, and, notwithstanding what Mr. Roechling said about the Leicester sewage farm, in his opinion clay land was quite unsuited for sewage disposal. Mr. Roechling complained that he had not said how the organisms were to be got rid of; his suggestion was as stated in his paper, that they, or rather the pathogenic forms, should be kept out of the sewage as far as possible, but if once admitted they could not be got rid of, and sewage authorities ought not to be asked to make the attempt. It was the water authority that was the offending party, if they elect to take water from a dangerous stream without taking steps to render that water pure—not the sewage disposal authority, who had a perfect right to run sewage into the stream so long as the effluent was pure according to our standard hitherto. It had been said that his suggestion

would take years to carry out, but he was afraid that Mr. Roechling's method would take centuries; and in fact was practically impossible, as suitable land was unobtainable in most cases. Of course it could be done if money were no object whatever. Mr. Scott-Moncrieff practically agreed with the paper, and Mr. Fowler admitted it was practically impossible to sterilise sewage. Mr. Archibald observed that it seemed to be forgotten that the Commission must investigate all points. Certainly they should investigate all points, including the bacterial quality of effluents; but why go the length of experimenting as to how to remove the bacteria unless they have some notion of attempting to enforce their removal? There were other more practical points which the Commission might usefully engage experts to work upon. With regard to chemical precipitation, he could not agree that it removed all bacteria, although, no doubt it reduced the number, and the filtration process following precipitation would not remove bacteria. His object in the paper had been to call attention to what appeared might be coming in the future so that opinion might be voiced in time. With regard to a standard, he did not see how such could be arrived at, even if it were desirable, until there was agreement as to the basis on which it should be established. There was no agreement now as to the basis; some take oxygen absorbed, some nitric nitrogen, others organic ammonia. It was true that in some places, such as Lancashire, there was a standard; in Staffordshire, also, there was a standard, although it was not officially laid down, and he thought it would be a fatal thing to endeavour to establish a standard for the country generally, because it would obviously have to be a low one. There could not be a uniform high standard, because in some places it might put authorities to large expense needlessly, and on the other hand, with a low standard, authorities would be permitted to discharge unsatisfactory effluents in the case of small streams which receive the sewage of large populations. Therefore he was against a uniform minimum standard.

The Chairman remarked that he could not agree with Dr. Reid that five-sixths of the matter in Dr. Houston's and Professor Boyce's reports are outside the scope of the Commission's work. It seemed to him that experts who are called upon to report upon the bacteriological condition of effluents, will find it necessary to point out the possibilities of danger that may lie in the presence of pathogenic germs. It was also their duty to consider different methods of sewage treatment in the light of this particular question; therefore he would not blame the experts for going fully into the matters. With regard to the Commission, he felt that if it were more generally appreciated how great was its work and how varied, they would see that time must be taken over the investigation. The Commission was anxious to arrive at its final conclusions, but the public must be patient. The Commission had just concluded its study of land processes and was now waiting for data in connection with so-called artificial filtration processes. A large number of works were under constant observation, and in the end they would be able to make a very useful contribution to the solution of

the question. One point which had not been touched upon that evening was the important question of the position of local authorities in regard to trade effluents. In many places that was a matter of extreme difficulty, and at present, under the varied interpretation of the law, some authorities receive trade effluents without conditions, some upon certain conditions only, and others will receive such effluents upon no conditions at all. Thus the position of manufacturers was a very difficult one, one man on one side of a stream having facilities for disposing of his effluent and another man on the other side having to go to great expense to treat his effluent. This matter had been before the Commission, and a report on the subject, a report which undoubtedly would be of great public interest, was in the hands of the printer and may daily be expected.

THE SANITATION OF JOHANNESBURG.

By W. H. DOBSON.

(ASSOCIATE.)

SITUATED at an elevation of some six thousand feet above the sea level, Johannesburg undoubtedly owes its general good health and absence from an epidemic to the natural dry pure atmosphere that its inhabitants enjoy; for it is at present without any modern sanitary appliances whatever.

The town has some 200 miles of streets, well laid out, and for the most part lighted with electric light.

A large busy city, the possessor of many noble and beautiful buildings in its main thoroughfares, it certainly gives the visitor a favourable first impression of being an up-to-date town. And this is particularly striking when it is recollected that less than twenty years ago the Witwatersrand was little more than open waste veldt, its few buildings simply iron sheds.

With the discovery of gold and the famous Main Reef came a large influx of people, and in the course of a few years Johannesburg has sprung into existence.

But unfortunately while building large edifices and stately blocks of offices above ground, no steps were taken to provide underground for the carrying off by drainage of the ever-increasing amount of offensive matter that a large population must necessarily produce, and the result is that to-day the "Golden City" is in a most insanitary, and in many parts disgust-

ing state, and is probably only saved from the outbreak of a decimating pestilence by its unusually healthy climatic conditions.

The present population of Johannesburg is about some 90,000, and this number may be reasonably expected to increase to say 130,000 to 150,000 in the near future.

During a large portion of the year an unpleasant feature is the clouds of fine dust that continually blow through the streets of the town. The water carts employed are quite incapable of laying the dust in anything like a satisfactory manner, and the utilization of oil instead of water alone (a system that has, I believe, given favourable results in Paris and other large towns) would no doubt considerably assist in abating this nuisance.

The only means of removing all offensive matter created by such a large number of people is by cartage through the streets of the town, and in spite of a large staff of carts and labour employed thereon, it will be readily seen that in a town of such a large area this system, however well carried out, cannot fail to be most unsatisfactory and a standing danger to public health.

It will thus be seen that the positions of the present members of the Town Council, who were elected by the Government upon the occupation of the town by the British, as well as those of the recently appointed Chief Officials and Heads of Departments, are by no means enviable ones, for the amount of work that lies before them in the improvement of the town entrusted to their care is enormous.

I trust nothing in this paper will be taken as in any way reflecting upon them, the present state of the town as herein described being the result of past years of inactivity.

The old boundary of the town controlled by the Council of Staatsraad, as it was called in those days, was a three-mile radius from the centre of the town; the present Council are endeavouring to have their administrative powers extended to a radius of six miles.

Johannesburg is split up into a number of small townships, some ten or twelve comprising the town proper.

The removal of night soil alone is estimated to cost £35,000 per annum to carry out, and entails the employment of a staff of 18 white overseers and 327 natives, with 294 animals, and 68 carts, 40 of which are of the old tumbler type.

Pails are removed either daily or tri-weekly, the charge made to the public being £10 per annum for the former and £5 per annum for the latter per pail. The removals are carried out at present in a manner to be most severely condemned, the pails used have no covering, and their contents are emptied into the carts in the streets.

The sight of a full pail, that has been overlooked at night, standing in the street in the morning is by no means an uncommon one.

The sanitary conveniences are, as a rule, of a most primitive and disgusting nature, being for the most part built of iron and wood, and usually in a more or less dilapidated state. I have seen many of them built of old packing cases, and in close proximity to rooms where food is prepared. Most of them have no proper floors, and the ground beneath is consequently impregnated with urine that has overflowed or been cast upon it.

In one of the largest and most elaborately fitted-up buildings in the town I noticed some of the very best glazed urinals, the downpipes of which led from three floors into receptacles below, and were *innocent of any traps*.

The general plan for the removal of slop and bath water from the larger buildings is to pump it up into storage tanks, from which it flows by gravitation into the carts in the streets. The odour given forth when the foul water and gases are thus stirred up may be left to the imagination of those who do not personally have to endure it.

In the suburbs of the town it is presumably the general rule to throw contaminated water into the streets.

About 60 carts and 180 men are employed on this work, and some 7,000 loads are removed a month*; this gives the amount of slop-water removed daily for each person at about 1 gallon, so it is obvious that the greater amount must be thrown about all over the town.

The recently-appointed town engineer is at present engaged in the preparation of a sewerage scheme for the town; this gentleman estimates the cost of a waterborne system at 13s. 5d. per head as against the present cost of £6 3s. per head per annum. The advantages of an efficient drainage, both from an economical as well as a sanitary point of view, cannot be more forcibly illustrated.

The nature of the sewerage installation to be put in for Johannesburg must to a great extent depend upon local conditions, both pro and con; perhaps one of the most important is the quantity of water available for flushing purposes. A population of 130,000 will require at least 5,000,000 (five million) gallons per diem for all purposes, plus the amount for flushing main sewers, etc.†

In spite of the reports we have of "subterranean rivers" and the

* = 90,000 gallons of slop-water daily removed at present.—[E. D.]

† = 38·4 gallons per head; seems to be an over-estimate. London is 35; average of 36 English towns, 33; of 30 German towns 27·7 gallons per head for all purposes.—[E. D.]

evidence given at water commissions, the water supply of the Rand is by no means certain. The yearly rainfall is 29 inches.

Johannesburg is subject to a rainy season and a dry one, during the latter many months may pass without hardly a day's rain.

It is also interesting to note that every ton of gold-bearing rock crushed on the mines requires 306 gallons of water from outside sources for washing.

A large quantity of water drunk in the town is from open wells, many of which, scattered about around the cemetery and at a lower level, cannot be too strongly condemned; some of them are within a hundred yards or so from where bodies are actually buried.

The treatment of sewage at the outfall or depositing site will also be one of some importance. In ground of extreme poorness for agricultural purposes the fertilizing qualities of sewage, when properly applied, should not be lost sight of.

It is interesting to note, *en passant*, that a well-known firm of engineers in South Africa, recognizing the scarcity of water for drainage purposes in the Transvaal, has given considerable attention to the introduction of the well-known Liernur system in the country. By this system, all sewage being forced through the pipes by the external atmospheric pressure acting against a vacuum within the pipes, water for flushing is, to a great extent, dispensed with. I have had opportunities of inspecting a Liernur installation put in upon one of the large mining properties (the Fereirra Gold Mine, Jonannesburg), capable of dealing with the sewage of the whole of the employees, and it appeared to work in a most satisfactory manner.

In many other respects, viz., dairies, butcheries, stables, etc., Johannesburg is capable of considerable improvement; on the other hand, it is gratifying to see that the Council is fully awake to the responsibility that rests with it for the immediate improvement of the town. Experts from home are engaged in preparing a scheme for an electric tramway service, and destructors are being erected to deal with the refuse of the town. Power is also being sought from Government in order to expropriate a large area of the most insanitary portion of the town in order to turn it into a more healthy spot, such as a public park, market-place, etc.

The high rental of properties and the difficulty of obtaining building materials is also of great importance. Small three- or four-roomed houses, suitable for the working-classes, are being charged for at the high rental of from £10 to £15 per month, and the satisfactory housing of the people is causing the authorities considerable anxiety.

During the past few years a fatal form of phthisis amongst miners, caused by the fine dust with which the air in mines becomes charged when rock drills are at work, and is inhaled by the men attending to them, has been engaging much attention from mining companies and those responsible for the control of the mining industry. After some years the lungs become impregnated with this dust, and difficulty of respiration and a hard cough are the outward result. This disease has been the cause of the premature death of many miners, and the Chamber of Mines is to be complimented on its recent offer of large rewards or prizes for an efficient invention to prevent the dust from entering the human system, and thus prolong the lives of the workers below ground.

That Johannesburg has before it a great future is without doubt: the home of the South African magnate, the centre of a world-famous mining industry, and blessed with an unsurpassed climate, it requires but time and the application of modern municipal engineering knowledge, together with far-seeing local administration, to become one of the healthiest and most desirable residential cities of the world.

Sewage Disposal in Johannesburg.

A joint report to the Public Health Committee of Johannesburg dealing with the disposal of sewage has been issued by Dr. C. Porter, Medical Officer of Health, and Mr. D. Listch, M.Inst.C.E., Town Engineer.

The report deals with the question as to whether the sanitary arrangements of Johannesburg are to be based on an improved dry-earth removal system, or on a system of sewers.

The Town Engineer expresses his opinion against the statement that sewerage is more costly than a dry earth system, as the waste which a sewerage system would remove includes, not only fæcal matters, but also slop water of every kind, and trade wastes. He asserts that at least twelve gallons of water per head per day are domestically used.

Whilst conceding that the dry-earth system is excellent for isolated houses, he maintains it is utterly unsuited to a large town.

He favours the separate systems of sewerage, for the reason that the rainfall is seasonal, and for five months in the year will not be available for flushing the sewers; besides which, the nature of much of the ground allows flood-water to run off with great rapidity.

He also points out that, owing to the topographical conditions, it is practically out of the question to drain the whole urban area to one outfall.

Concluding, by saying that he strongly recommends the adoption of a

sewerage system, laying stress on the fact that storm-waters must be excluded for financial, sanitary, and aesthetic reasons.

In view of the above reports the Public Health Committee recommend: (*a*) That this Committee submit to the Council, plans, specifications, and estimates for the construction of drains and sewers, in such parts of the municipal area as may seem desirable; (*b*) that such drains and sewers be designed for sanitary purposes only, and that storm-water be excluded therefrom; (*c*) that a sum of £340 be authorised for the purpose of preliminary surveys, etc.

Note by Dr. S. Rideal (London).

In July, 1901, I had to examine an exceptionally strong sewage, and also a sample of slop water, from Bloemfontein, Orange Colony. The former was a thick, yellow, extremely offensive liquid, containing large quantities of suspended matter, seeds, and fruit pulp, and was evolving gases, including sulphuretted hydrogen. It was strongly alkaline, owing both to fixed alkali and to ammonia as carbonate and sulphide.

The slops resembled strong greyish soap suds, but had a powerful odour and a considerable curdy scum and sediment. They also contained both fixed and volatile alkali, but in less quantity than the sewage. The amounts in each case were:—

	Parts per 100,000.	
	Sewage.	Slops.
Volatile alkali as NH_3	652·8	34·85
Fixed alkali as Na_2O	111·6	28·15

I subjoin the analyses, which are very interesting, as they are among the strongest specimens I have met with, and present some peculiar difficulties in treatment, on which I was asked at the time to advise. Samples of related character, however, occur in places where water is scarce, and will probably be met with in Johannesburg.

I gather from the percentage of nitrogen in the dissolved organic solids of the sewage, that they contain nearly half their weight of urea, and as they reach 1·1 per cent. of the sewage (1,108 parts in 100,000), while the urea in urine averages about 1½ to 2 per cent., the sewage must contain at least one-fourth of its volume of *undecomposed* urine. The proportion of urine originally present, judged from the chlorine percentage (0·27) in the sewage, would seem to have been at least one-half, as urine shows an average of about 0·4 to 0·5 per cent. of chlorine. This makes it resemble rather a midden contents, or the product of a pail system such as Mr. Dobson describes in his paper.

To obtain the analysis of the dissolved solids, it was necessary to dilute the sample to ten times its volume, and I then discovered that the liquid had a very rapid action on paper, as it attacked and burst even a strong double filter in 15 minutes, causing it to shrink, become pulpy, and gradually dissolve. This was an indication of the presence of active cellulose-resolving bacteria, and of their enzymes such as cytase. The slops undiluted had a similar effect in three hours.

It follows that even a sewage of such concentration may possess in an energetic degree, as in this case, one of the most valuable properties conducive to bacterial treatment, namely a vigorous hydrolytic and cellulose-resolving action, which, if it were mixed with a diluter sewage, would materially hasten the breaking up of intractable residues in the latter.

But when we come to the further stages accompanied by aëration, we find that considerable dilution is necessary. The prejudicial influence of large quantities of ammonia on the nitrifying bacteria was observed by Warington in 1891. Winogradsky and Omeliansky proved in 1899 that 0·5 per cent. of urea hindered nitrification, and that addition of 2 per cent. of urine resulted in the time required for oxidation being increased five times, the effect being due to the large excess of ammonia formed.

The slop water is also highly ammoniacal, consequently would not answer alone as a diluent. We may calculate that from 50 to 100 volumes of water would be required to be added to this sewage before it would be comparable with the liquids ordinarily treated with success by bacteria beds or passage through land.

In the so-called "contact" or Dibdin system, the sewage is generally strained and sedimented before entering the beds. Incidentally I may mention, as I many years ago pointed out, that this is really an evasion of complete biological treatment. The above sewage was too viscid to strain: when diluted to ten volumes with water and filtered, it gave a brown clear liquid of very offensive odour, more urinous than fæcal. Bacterial action was then rapid, and in three days it was turbid, had a scum and a deposit, and a sweetish odour. The filtrate from the undiluted slops was nearly clear and light brown: it also became turbid in three days and the odour changed. Besides the difficulty that the liquids would not nitrify, the clogging of the filters was extremely rapid. The large quantity of solid residue must also be separately dealt with, pressed, dried and burnt, or dug into land—methods known to be expensive. The liquids could not be discharged into rivers or watercourses, or even irrigated, as the further changes are attended by strong odours and poisonous products.

There remain only two alternatives:—

1. Dilution with water or a weaker sewage in the large proportion I have already indicated, succeeded by tanks, roughing beds, and nitrifying filters, or by careful application to porous land. It is unnecessary to point out the advantages of these natural methods, if attainable.

2. The Liernur system of pneumatic transport followed by a modified Kjeldahling of the material, in this case derives a benefit from the small bulk of the sewage and its concentration. It will be noticed that the organic matter in the sewage contains 10·85 per cent. of nitrogen, and in the slops 7·12 per cent., and it appears that this would be rendered available in a manurial form or converted into ammonia salts, besides the large amount of ammonia already present, and of the easily convertible urea.

Analyses in Parts per 100,000.

SEWAGE.

		Chlorine.	Oxygen consumed.	Nitrogen.		
				Ammoniacal.	Organic.	Total.
Solids suspended:						
Organic	3104·0	.....	737·6	.....	183·8	183·8
Mineral	318·0					
Total	3422·0					
Solids dissolved:						
Organic	1108·0	.....	393·6	.....	273·3	
Mineral	726·0	273·6				
Total	1834·0	[= NaCl 450·7]	.....	537·6	.....	810·9
Total Solids:						
Organic	4212·0					
Mineral	1044·0	273·6				
Total	5256·0	.....	1131·2	537·6	457·1	994·7

Percentage Composition of the Solids.

	Total Solids.	Suspended.	Dissolved.
Organic	80·14	90·71	60·42
Mineral	19·86	9·29	39·58
Percentage of Organic Nitrogen in the Organic matter	10·85	5·92	24·67*
Percentage of Oxygen consumed by the Organic matter	26·85	23·76	35·52†

* Urea contains 46·7 per cent. N. † Urea requires 80 per cent. oxygen for complete oxidation.

SLOPS.

		Chlorine.	Oxygen Consumed.	Nitrogen.		
				Ammoniacal.	Organic.	Total.
Solids suspended:						
Organic	102·4	.....	64·92	.....	8·95	8·95
Mineral	38·4					
Total	140·8					
Solids dissolved:						
Organic	88·2	.....	25·28		4·62	
Mineral	113·2	46·0				
Total	201·4	[= NaCl 75·8]		28·7		33·32
Total Solids:						
Organic	190·6					
Mineral	151·6	46·0				
Total	342·2		90·2	28·7	13·57	42·27

Percentage Composition of the Solids.

	Total Solids.	Suspended.	Dissolved.
Organic	55·7	72·73	43·79
Mineral	44·3	27·27	56·21
Percentage of Organic Nitrogen in the Organic matter	7·12	8·74	5·24
Percentage of Oxygen consumed by the Organic matter	47·3	63·6	28·7

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these cases see "Law Reports," which can be referred to in the Library of the Institute.

LANDLORD AND TENANT (Lease).—*Covenant by Lessee to pay and discharge impositions*—"*Impositions charged or imposed in respect of the premises*"—*Order by Sanitary Authority on Lessor to do structural works.*

A lease for years contained a covenant by the lessee to "pay and discharge all taxes, rates, including sewers, main drainage assessments and impositions whatsoever, which now are or may at any time or times hereafter during the continuance of the said term hereby granted be taxed, rated, assessed, charged, or imposed upon, or in respect of the said premises, or any part thereof on the landlord, tenant, or occupier of the same premises, by authority of Parliament or otherwise howsoever (landlord's property tax and tithe only excepted)."

There was no repairing covenant in the lease. Notice was given to the lessor by the sanitary authority of the district under the Public Health (London) Act, 1891, to abate a nuisance caused by a foul and offensive privy on the premises, by removing the privy and constructing a water-closet in accordance with the by-laws of the London County Council. The lessor thereupon did the work required by the notice, and subsequently sued the lessee to recover the expense incurred by him in so doing:—

Held (reversing the decision of a Div. Ct. 1901, 2 K.B. 151), that this expense was covered by the words "impositions charged or imposed upon or in respect of the said premises on the landlord, tenant, or occupier of the same" in the covenant, and therefore that the action was maintainable.

FOULGER *v.* HARDING. C.A. [1902] W.N. 55. [1902] I. K.B. 700.

WATER.—*Supply—"Domestic purposes"—Swimming-bath—School—Waterworks Clauses Act, 1847 (10 & 11 Vict. c. 17), s. 53; Waterworks Clauses Act, 1863 (26 & 27 Vict. c. 93), s. 12—Public Health Act, 1875 (38 & 39 Vict. c. 55), ss. 51, 56, 57.*

The governors of a school, carried on as a charity and not for purposes of profit, constructed a swimming-bath for the use of the boys.

The bath was in a building outside the main building of the school, but was connected with it by a corridor, and was separately rated for poor rate.

A swimming-master was kept to teach the boys swimming, and a fee was charged for the use of the bath. This fee was compulsory for the boarders, but was charged to such only of the day boys as used the bath.

Held by the C. A. (Vaughan Williams, L. J., doubting) that under the circumstances the water supplied to the bath was not supplied for "domestic purposes" within the meaning of s. 12 of the Waterworks Clauses Act, 1863, but was supplied for the business of the school, and that consequently the water authority were entitled to make a special charge for the supply.

Decision of Buckley, J. [1901] W. N. 173 [1901] 2 Ch. 813 reversed.

Semble, that a supply of water to a swimming-bath for the use of the occupier of a dwelling-house and his family may be a supply for domestic purposes.

Per Vaughan Williams, L. J. A supply of water for domestic purposes is not limited to a supply inside the dwelling-house of the occupier, nor must it be a supply which is essential to the occupation, or even to the healthy occupation, of the house.

Water supplied for the purpose of making the occupation of a house more convenient, or for increasing its amenities, is prima facie supplied for "domestic purposes."

Per Romer, L. J. The true test whether water is supplied for domestic purposes is not whether it is used by the occupier for the private purposes of himself and his household. Regard must be had to the ordinary habits of domestic life, and to what can reasonably be considered a "domestic purpose."

The test of reasonableness ought also to be applied to the quantity of water required, and regard should be had, not only to the consumer, but also to the obligation of the water authority to afford a supply to their district for ordinary domestic purposes.

In each case the Court must see whether the supply required is reasonably a supply for domestic purposes.

Barnard Castle Urban District Council *v.* Wilson. C.A. [1902] W.N. 146. [1902] 2 Ch. 946.

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CONGRESS AT BRADFORD.

INAUGURAL ADDRESS

By The Right Hon. THE EARL OF STAMFORD.

(Vice-President and Fellow.)

President of the Congress.

Delivered July 7th, 1903.

INTRODUCTION.

IN taking the chair this evening I am desirous of placing on record my deep sense of the privilege and honour conferred upon me by my appointment as President of this Congress.

My first duty as President—and I need scarcely say with what gratification I perform it—consists in extending a cordial welcome to all who have come to take part in these proceedings. I trust that your presence may result not only in pleasure and interest to yourselves, but also in some definite addition to our knowledge of sanitary science, which we are here assembled to advance.

My next duty consists in conveying, on your behalf, the heartfelt thanks of this Congress to the Mayor and Corporation of Bradford for the courtesy and hospitality which have been so freely extended to us all.

It is with peculiar personal pleasure that I now revisit this city, where on more than one occasion I have come into intimate relation with some of its prominent citizens in connection with that thorny problem, the organisation of charitable relief. I remember with great appreciation the public spirit, the patriotic sentiment, the energy and the generosity of the men of Bradford, and there is no city in this great and historic county in which I feel more sure of a hearty Yorkshire greeting.

The meeting this evening inaugurates the Twenty-first Congress held by The Sanitary Institute, a Society which represents one of the largest voluntary efforts for advancing the knowledge of hygiene. Since its formation in 1876 it has kept pace with the enormous strides made by hygiene in the past quarter of a century, and from small beginnings has grown to a society numbering 3,000 members and associates, spread throughout the civilized world; and it has regular centres of organized work in the principal colonies of the empire. The object for which it was founded was the diffusion of sanitary knowledge, and the channels through which it seeks to accomplish this work are many and various:—Lectures, Discussions, Experiments, Examinations, Exhibitions, Congresses, and publications in every continent of the world; the meetings held under its auspices last year numbering nearly 500, and the total attendances at these meetings over 50,000.

In addressing such an audience as this before me—an audience containing so many men of high scientific attainments, each an expert in some one or more branches of sanitation—it would be in the highest degree presumptuous of me if I were to attempt to instruct you in such matters.

But as an average intelligent observer, and as one taking the keenest interest in the subject, I may be permitted to direct your attention not so much to the scientific side of sanitation, as to its general aspects and scope, to its effects upon history, and to its application by means of political and administrative methods.

For without such application duly organised and co-ordinated, all the scientific knowledge in the world becomes practically of little avail. Moreover, immense as has been the advancement of scientific knowledge during the past century, we are to-day only standing upon the threshold of those questions which affect the health of the individual, and immense too as has been the advance in the social amelioration of the masses, we have only recently entered the field of organised warfare against insanitary conditions—the hereditary foes of the human race.

More and more is it now becoming recognised that these foes can only

be combated by the organised application of scientific and economic principles. Already we stand at the parting of the ways. More and more is it becoming clear that indiscriminate public and private charities can never, for all their abundance, mitigate a tithe of the evil, misery, and pauperism, incidents of the accumulation of the very wealth out of which those charities are supported.

In spite of all our efforts at charitable relief—nay, rather because of them—the evil increases and individual attempts to arrest the rising tide become futile. Before our eyes spreads the depopulated country-side, and into our cities in increasing crowds pour the men and women who were once, and surely should ever be, the backbone and glory of the nation, but who now go to swell the ranks of the unemployed, and to become the victims of the city slums.

For these and all the other cognate evils of to-day, our eyes turn for salvation and help to sanitation, and Lord Beaconsfield's aphorism "Sanitas Sanitatum, omnia Sanitas," once lightly regarded or derided, has become a mighty and accepted truth.

As Dr. Parkes has aptly stated, "Hygiene is the art of preserving health; it signifies perfect culture of mind and body, and aims at rendering growth more perfect, life more vigorous, and death more remote." Hygiene is not a fixed science, it is and will ever be progressive so long as death and disease exist as facts. It is an important factor in every science which concerns the life of individuals or communities; for instance, now that entomology has taught us that the malaria germ is borne through the air by the anopheles mosquito, Hygiene may enable us to deal with that evil and relegate tropical fever to the limbo of the sweating sickness, and thus open up the resources of the rich but deadly regions of West Africa.*

HYGIENE IN HISTORY.

Hygiene or its neglect supplies the key to much history—political, social, and economic.

We may recall how epidemics have affected the progress of mankind: how, if we may quote the Biblical record, the avenging plague liberated Israel from Egypt, and how in that exodus our modern history lies hid.

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* Allusion is here made to the Liverpool School of Tropical Medicine, founded by Sir Alfred Jones, K.C.M.G. Compare also "The Geography of Disease," by Dr. F. G. Clemow: Cambridge University Press, June, 1903.

The Sanitary Code of the Pentateuch, the most comprehensive and detailed system ever applied to the individual, may have been its direct result.

In the reign of Hezekiah, Jerusalem, and with it the civilization of a third of the human race, lay at the mercy of an Assyrian host. In a single night pestilence slew 180,000 men, and liberated the Western world from the worn-out superstitions of the philosophers of Nineveh. The Roman Empire has been held by Gibbon and other historians to have perished mainly through epidemics. The pestilences of the second and again of the sixth centuries depleted the hardy peasantry from which Rome and Constantinople had drawn their armies and turned Italy, Asia Minor and Syria into desert wastes. The decimated population was unable to sustain the undiminished exactions of the tax-collector and the recruiting sergeant, and the Teutonic and Arab races were enabled to advance almost unopposed into that Mediterranean area which had been the centre of the civilization of the ancient world.

To turn to our own annals, it must be obvious to all of us how intimately connected sanitary science has been with the political and social growth of the British race. One by one diseases which in former days used, with periodical frequency, to decimate and more than decimate our population, have been stamped out or rendered comparatively innocuous by the application of the laws of sanitation.

It is a mistake to suppose that mediæval municipalities neglected hygiene. The records of the Historical Manuscripts Commission serve, and more than serve, to show that nearly every corporation in the thirteenth, fourteenth, fifteenth and sixteenth centuries was for ever legislating to secure the cleanliness and healthiness of the borough committed to its charge. It was not the fault of the Town Councillor but of the mechanician that these recommendations proved so futile in actual life. Drain pipes could not be cast on the potter's wheel, and water could only be conveyed through the trunks of elm trees laboriously drilled by hand. The theories of hygiene and of drainage were well known. The mighty vaulted drains of brick, whose proportions almost recall the Cloaca Maxima of Rome, which surround Eton College, Hampton Court and the ruins of Saint Augustine's Abbey at Canterbury, remain to prove the precautions by which their builders secured these stately piles from the invasion of the pestilence; but such structures could not be made on a scale extensive enough to suffice for the needs of a mediæval city. Main drainage only became a possibility when Watt's brain evolved the utilization of steam.

But the imperfection of mediæval sanitary appliances profoundly influenced both religion and economics. It is not too much to say that the Reformation was the final outcome of the "black death" of 1348, which, by depleting the ranks of the clergy, broke up the old organization of the mediæval church and threw it into the hands of those unworthy priests who "creep, and intrude, and climb into the fold."* Again, the scarcity of labour after the plague, made the worker with his hands master of the market. The legislation, by which a parliament of employers, in their panic, sought to keep down the rate of wages, not only led to the insurrection of Wat Tyler—which was the first socialistic movement in English history—but some 300 years later became one of the main causes of modern pauperism, in that it prevented generations of workers from using their labour to the best advantage to themselves.

The Statute of Labourers, which enabled the justices to fix the rate of wages, and the Settlement Laws, which bound the toiler to his native soil, were passed in the latter part of the fourteenth century. They were only repealed in 1824. Their ultimate results first became evident when there was once more a surplus population in England. All testimony goes to show that the unchecked ravages of the plague had their advantage for the worker. As Sir Walter Besant pointed out, they served to determine the rate of wages in his favour; and thus for centuries prevented the rise of a pauper class.

In 1666 the plague disappeared, and small-pox took its place, and continued to check any excessive growth of population until the early years of George III., just when improvements in machinery were beginning to change England from an agricultural into a manufacturing country. Thus the English labour market was for ages regulated by epidemics.

The plague also left its mark on literature and art. Who can read "Paradise Lost" and "Paradise Regained" without remembering that they were partly written during the great plague of London? The production of Shakespeare's plays synchronises with the temporary cessations of pestilence in the later years of Elizabeth and first years of James I. Who can forget the plague pictures of Titian and Tintoretto, or Holbein's "Dance of Death"?

Such are but a few of the ways in which disease has influenced the course of the history of man.

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*Milton's "Lycidas."

Hygiene of to-day.

I now propose to deal with the subject of modern sanitation in its connection with the home, the school, and the factory, and to add some remarks upon the two special subjects of consumption and sewage, which I have singled out from the numerous questions of hygiene which affect our national and municipal life.

Hygiene in the Home.

The first point with which I am attempting to deal very briefly is hygiene as affecting the house and home.

The shifting of population from country districts into towns has tended to cause congestion in some urban areas: and it is gradually being discovered that in some, if not in many, rural districts the available dwellings are not only full of sanitary defects, but insufficient in number even for the demands of a diminished but still considerable population, and that there is no financial inducement to create further accommodation, because it cannot be provided in a form which will satisfy the public authorities without incurring a cost involving a rent which the country tenant is unable to pay.

The number of agricultural labourers in England has decreased in the the last half-century from three-and-a-half to two-and-a-half millions, while in the same period there has been a rise of eight-and-a-half millions sterling—or rather more than fifty per cent.—in their wages, and this has been accompanied by a widespread discontinuance of women workers on the land. From these remarkable facts it has been maintained that the position of the farm labourer has materially improved, and that he can now pay more rent and thus ensure a better home for his family. To some extent this is doubtless the case, but it is contended with much truth that inasmuch as the wages of the builders' workmen and building materials have increased in at least equal proportions, the problem of providing better cottages remains unsolved.*

I have not sufficient experience in the rural housing question, which presents such widely divergent aspects in different parts of the country, to do more than refer to the suggested remedies of collective ownership of lands and houses by municipalities or co-operative societies, and of State-aid by way of cheap loans. I would strongly urge that all voluntary efforts should be encouraged, and that a combination of public and private

* Compare Mulhall's "National Progress during the Queen's Reign."

enterprise should be effected, there being ample room for both methods. But of paramount importance for the cure of present defects is the education of the country at large as to its responsibility for the existence of those defects, and more especially the instruction of the working classes themselves as to the necessity of their being provided with healthy homes. If by some organised crusade the working classes could be induced to learn this lesson, the power of their votes would speedily accelerate the wheels of the Legislative machine.

In towns the requirements of modern building rules and sanitary laws are having a deterrent effect on private enterprise in building, and the task of ensuring proper housing is gradually passing from private hands to those of municipalities or the state. There are many causes for this tendency. The increasing stringency of legislation and administration with reference to matters affecting the public health marks a great change from the conditions of sanitation and local sentiment described by Charles Kingsley in "Two Years Ago," just before the Crimean War. The Public Health Acts of 1875 and 1890, with the special Corporation Acts of many boroughs, now embody a full though not perfect machinery for detecting and remedying insanitary conditions. But these Acts contain no provisions for re-housing, and their administrators are often deterred from enforcing their powers to the full by knowing that to do so will be to dis-house, and perhaps force into the workhouse, people who are only living in a congested district because they cannot find sufficient accommodation elsewhere at a rent which they are able to pay.

The scientific study of matters affecting the public health and the experience gained in enforcing the Sanitary Laws has resulted in the accumulation of a mass of knowledge and information as to the effect of overcrowded and unhealthy dwellings on the national health. The penalties for disobedience to Sanitary Laws are usually enforced against owners or occupiers, and the sub-tenants or lodgers go scot free. But much of the ill-health and disease in slums is directly traceable, not to the neglect or default of the landlords, but to the personal defaults of the poor who dwell in them. Vicious and drunken habits and disregard of personal cleanliness are powerful factors in the lowering of public health in poor districts, factors with which it is difficult, if not impossible, to deal by legislation. The only way to cope with personal neglect of matters affecting health will be by education of such people, or, if they are hopeless, by the education of their children, in the principles of hygiene, so as to make its practice by future generations instinctive or habitual, a point upon which I shall endeavour to dwell at more length hereafter.

The last fifty years have been marked by an enormous improvement in sanitary legislation and administration: and it may now, I think, be said that while rural districts are still somewhat backward, in most towns the sanitary authority is both efficient and progressive, and is doing for sanitation as much as the law allows. An inevitable result of this activity and progress has been to bring our administrators face to face with the serious question how best to deal with overcrowded and insanitary areas, and to create a widespread public interest in the subject of re-housing of the poorer classes under conditions which will benefit the public health and conduce to the welfare of the persons re-housed.

That interest has been manifested by the activity of many members of Parliament in introducing projects for remedial legislation, and by the creation of voluntary societies for the purpose of ameliorating the condition of congested districts—of these I will here only name the Mansion House Council on the Dwellings of the Poor which has existed since 1884, the Housing Reform Council, which is active in collecting materials for amendment of the law, and the newly formed Rural Housing Association, which seeks to stimulate public interest in the improvement of labourers' dwellings in England, as to which the law is far behind that of Ireland, where already, though by no means too soon, much has been done under the Labourers' (Ireland) Acts through the erection of some 15,000 cottages. Besides these manifestations of voluntary activity, which in England are symptomatic of growing public interest and stimulate the emulation, though perhaps also they awaken the hostility of the public authorities, much is being done by individual students and writers. Two of these I may specially mention without detracting from the merits of the rest. Mr. Rider Haggard, in his recent work on Agricultural England, describes from his own visits the condition of many parts of rural England with reference to the housing of labourers, in a manner which calls for the most attentive study by all who wish to devise a means whereby the rural labourer may be so reasonably and efficiently housed as have a sufficient inducement to remain on the land rather than to seek his fortune or misfortune in the slums of a crowded city. The other is Alderman W. Thompson of Richmond, Surrey, whose handbook on "Housing," published this year, contains a mass of the most valuable information as to the steps taken throughout the country to provide for re-housing, and the particular schemes adopted (including pictures, plans, and statistics), and also deals with the difficulties of finance and working which have been experienced in those districts which have been pioneers in re-housing.

It is both satisfactory and encouraging to this Institute to find so much unofficial interest in questions of so great national importance, and if we turn to what may be described as the official side of the matter, I think that I may say that work of no less value, and work perhaps closer to the practical aspects of the problem of re-housing is being done by the County Council in London and by other local authorities throughout the three kingdoms.

The great cities of London, Glasgow, Liverpool and Manchester, and last but not least, this city in which we are meeting, have taken serious steps to cope with the housing question. The Bradford scheme, as described by Dr. Evans last year to this Congress, involved the acquisition of the insanitary area of Longlands inhabited by 1,357 persons; the clearing away of the old buildings; the erection on the old site of 146 tenements to house 432 persons, and the accommodation of the rest of the displaced population in 114 new houses at some distance from the Longlands area. The estimate of the cost of the whole scheme was stated to be £83,000. The Congress will welcome the further report which will no doubt be before us, and will show the progress made with the scheme and the extent to which anticipations as to its cost and beneficial effects have thus far been realised.

Hygiene in the School.

It is obvious that in the case of children the influences of even the the most perfect hygienic home are necessarily more or less diminished, if not completely counteracted, by the insanitary conditions of school life. In this country we have so far recognised the situation by the large amount of careful attention which we have paid to the sanitary construction of school buildings, the requisite proportions of light and air space, ventilation, heating and sanitary accommodation, and general equipment. But as yet we have not made any real attempt to inaugurate upon national lines a system of hygienic instruction. I can speak the more freely upon this question, since Bradford is situated in a district where so many advanced ideas of education have been worked out, not only in the elementary schools under the able supervision of Dr. Kerr, but also in the technical education schools provided by the West Riding County Council, the one local authority which, in conjunction with the Education Department and The Sanitary Institute, despatched a special commission to investigate the provision made for hygienic instruction in the United States of America. It is therefore with every confidence that I invite your attention to this system of national education.

In their determination to secure and promote the health and prosperity of the population, the American people have recognised that a real educational system is the most important factor, and in attaining such a system they have further recognised that physical development is as essential as mental growth, and that the latter cannot exist without the former. The high standard of hygienic knowledge and practice demanded by public opinion may be gathered from the official instructions issued by their Board of Education. Although this high standard may not be attained in practice, yet the American people are too businesslike to be satisfied with mere theories, which may or may not be applied by the individual teacher. It is not sufficient that the child should be taught merely to observe certain hygienic regulations. It must understand the reasons; and these can only be efficiently taught by teachers specially trained in the science and practice of hygiene.

The Americans have therefore established in the majority of the States free training schools for teachers, in which the training of school hygienists occupies perhaps the leading position.

Teachers College, Columbia University, holds the premier place as the institution for the trained school hygienist. Its Faculty has successfully demonstrated the scientific value, dignity and claims, of a full four-years' course of academic and professional study of the science of teaching, which includes an exhaustive apprenticeship to school hygiene.

A department of physical education has recently been organised and equipped, the importance of which cannot be too strongly emphasised.

And the Faculty of Teachers College has further demonstrated that although all teachers cannot be experts in school hygiene, yet after a training in its elementary principles they are capable under the supervision of specially trained hygienic experts of performing the duty of securing the hygienic environment of the child, physical, mental and moral.

I have alluded, at some length, to the integral position which the training school for teachers occupies in the American University, and, through the University, in the national system of education, largely because experience has proved that our own training colleges for primary teachers were tending to become too narrowly technical, and to acquire a caste character.

From this position they are now being rescued by the indirect influence of the London and other universities, and it would be calamitous if those responsible for the training of secondary teachers were to fall into an error from which the primary grade is being emancipated—the imposition of a narrow technical preparation.

Unless our training schools for teachers form part of a co-ordinated system of national education, unless they are dominated by a university or other liberal institution, they will inevitably fall into the hands of persons who with the best intentions, but small philosophy, will try to make short cuts by ignoring the great broad highways of intellectual development. It is along the lines initiated by the American people, that in the opinion of educational experts here, England is destined to advance, and it is your special duty to see that the science of sanitation occupies a prominent position in our system of national education.

Moreover, with the whole of our educational system in the melting-pot, with the transfer of our schools from purely educational bodies to local authorities intrusted with wider powers, including matters of public health, the moment is singularly appropriate for directing special attention to this most vital question of hygienic training for teachers.

The British Association has appointed a special Committee to investigate this subject, but their investigation, so far, into the interest shown by school authorities and the knowledge possessed by teachers, is a catalogue of indifference and incompetence with regard to children's health, physically, mentally, and morally.

Surely it should be one of the first requirements in the preparation of the teacher, and also of the inspectors who are appointed to visit the schools, that they should practically understand something of the nature of the child material upon which they are to work, the conditions under which the child can best develop by the teacher's guidance, and the proper use of the appliances provided in modern school buildings.

The most learned teacher is of little use for educating others without this knowledge, and yet so imbued is the present generation with the idea that the whole preparation of a teacher to care for the young, is to obtain certificates and honours in some special branch of learning, that the necessity of grasping hygienic principles has been generally ignored, and it has even been suggested that teachers have no time for the study of hygiene, because they have to pass in Greek before they leave the training college.

Is not this in every way a retrograde step in the science of the day, to suppose that the health conditions of the body can be separated from the proper development of the mind? and is it not time that the common sense of the parent, and public opinion, should be set to balance this inordinate craving for mere knowledge as an adequate training for a teacher?

Although we are still far from a co-ordinated scheme of national education, it is encouraging to find that courses for the training of

teachers in school hygiene are being provided by some technical education authorities. Three years ago the West Riding County Council established courses of such training for teachers under the guidance of Miss Alice Ravenhill, to whom the country is indebted for her valuable report on Hygienic Instruction in the United States. These courses, which are very comprehensive, have since been continued, and many of the teachers have put their training to the test by entering the examinations upon the hygienic requirements of school life, provided by The Sanitary Institute.

Hygiene in the Factory and Workshop.

Hygienic regulations are no less indispensable in the factory or workshop than in home or school life. They are important not merely to the individual employé, but to the community at large. As Dr. Ferriar cynically observed, the "safety of the rich is intimately connected with the welfare of the poor."

This solidarity of interest has been so far recognised that of all social endeavours Factory Legislation is the most widely diffused throughout the civilized world. The system of regulation which commenced in this country with the protection in 1802 of a tiny class of pauper apprentices in textile mills, now includes within its scope every manual worker in every manufacturing industry in the country. The range of factory legislation has in fact become co-extensive with the conditions of industrial employment. No class of manual-working wage-earners, no item in the wage contract, no age, no sex, no trade or occupation is now beyond its scope. It has commended itself to the practical judgment of the civilized world, and has become as soundly "orthodox" amongst the present generation of English, German, and American economists as *laissez-faire* was to their predecessors. Moreover, so general has been the consensus of public opinion in favour of these legislative restrictions that the officials of Trade Unions and Employers' Associations alike have vied with the Factory Inspector in the administration of the law.

Whilst some consider that the maximum of state control has been reached, others maintain that the minimum only has been attained. It is therefore interesting to observe that at the present Congress the subject of Factory Legislation is to be discussed from the point of view of the manufacturer and of the workman.

And yet in spite of this immense advance, in certain noxious trades and in the "sweated" industries, many of the evils and horrors of the old pre-factory system days are being faithfully reproduced. For these

legislation exists only in a most rudimentary form, and even this limited control, owing to the overlapping and clashing of authorities, is most inefficiently administered. In their Final Report on the Sweating System, the Select Committee of the House of Lords stated that there was nothing to prevent any employer or operative from competing in the downward grade with "earnings barely sufficient to sustain existence; hours of labour such as to make the lives of the workers periods of almost ceaseless toil; sanitary conditions injurious to the health of the persons employed and dangerous to the public."

An important change was effected by the Factory Act, 1891, by which the supervision of the sanitary condition of workshops was transferred to existing local sanitary authorities and a system of dual control introduced. The compulsory provisions of the Factory Act, 1895, mark a great advance in the activity of sanitary authorities but, with some notable exceptions, such as Liverpool, Manchester, Nottingham, Leeds, Bradford, and several of the borough councils in London, local authorities have signally failed to recognise their responsibilities. In spite of this failure the Factory and Workshop Consolidation Act, 1901, granted increased powers to local authorities. Some may be disposed to condemn this system of dual control which, speaking generally, has proved so inefficient. A little consideration however will show that its partial failure is due not to any inherent weakness in the system itself but to imperfections in the law, the chief of which have been (1) the insufficient powers given to local authorities; (2) the overlapping of functions between factory and sanitary inspectors; and (3) the lack of any adequate control by which compulsion might be brought to bear upon defaulting local authorities.

Owing to these imperfections, due in many cases to careless draughtsmanship and want of careful definition, the majority of the workshops are in very much the same condition as that of the cotton factories in the early part of the nineteenth century, when the law, from its indefiniteness and the absence of specific requirements, remained a dead letter.

At present it is almost impossible to ascertain the whereabouts of domestic workshops, and even when this initial difficulty has been overcome, it will perhaps be hopeless to expect that the regulations for the home-workers will ever be brought up to the level of Factory Act requirements; but it is at least imperative that the Act should be amended so as to ensure that all workshops shall be subject to inspection and control.

One of the noxious trades of special interest to this county is that of file-cutting. It is undoubtedly one of the most dangerous trades in

existence. Its death-rate is higher than that prevailing in any other handicraft, and yet hitherto it has been entirely unregulated.

This question was at our last meeting fully considered and the opinion that the industry should be declared dangerous placed on record.

I have the gratification of being able to inform you that the Home Secretary has recently scheduled this trade as "dangerous" by virtue of Section 82 of the Factory and Workshops Consolidation Act, 1901, and that regulations for enforcing cleanliness and ventilation in the shops and sheds where this industry is carried on are now being framed.

In drawing your attention to such noxious trades and "sweated" industries, I desire to enforce the view that they are not only injurious to the persons more immediately concerned, but to the whole nation. These trades become parasitic on the rest of the community and are fostered at the expense of other trades, by what is virtually a bounty, in the form of unlimited cheap labour.

It is the object of Factory Legislation to prevent the diversion of the national industry into such unprofitable channels; to maintain a healthy minimum in the standard of life; and to prevent any person being employed under conditions inimical to social health. "The ultimate end of Factory Legislation," says the *Times*, "is to prescribe the conditions of existence below which population shall not decline."

Consumption.

In turning from the review of sanitation, as it affects the child, the parent, and the worker, to the special subjects of Consumption and Sewage, I feel that a fuller and more technical treatment becomes necessary.

When we see that the annual average of deaths arising from pulmonary tuberculosis for the decade ending with the year 1900 was no less than 42,613, and that one death in every five of persons between the ages of 15 and 55 years occurred from this cause during that period, we hail with feelings of the deepest thankfulness the successive steps towards knowledge and consequent correct treatment of the disease which have been taken in the last twenty years. Briefly and popularly, these steps may be summarised as follows: Koch's discovery in 1882 of the tubercle bacillus destroyed the previous general belief that consumption was hereditary in its origin, and replaced that belief by demonstrating that its cause was infectious, not hereditary. Again, it has been proved by post mortem examination that complete recovery from pulmonary consumption can and does occur. The chief means by which infection may be conveyed,

namely by the inhaling of tubercle bacilli which have been discharged into the air by the consumptive, are simple, apparent, and capable of suppression, while the bacillus itself, under proper treatment, is less tenacious of life than most of its tribe. Though no absolute specific has yet been found, the mere gradual growth of modern sanitation, without the aid of special treatment, has brought with it a steady decrease of the mortality arising from consumption, which to-day is fifty per cent. lower than it was forty years ago. If these improvements in general sanitary conditions, by the provision of better food, more light and air, and greater cleanliness have thus effectually diminished the deadliness of the disease, we are warranted in our belief that further scientific discoveries and improved systems of specific prevention and treatment will finally lead to its approximate, if not total extinction.

The immediate and pressing problem, however, is how to utilise our present and improved knowledge and experience for the benefit of the *poorer classes*, as it may be assumed that those possessed of sufficient means will of their own volition and at their own expense avail themselves of the means of amelioration and cure which are ready at hand for their adoption. In this direction—namely, the application of all known remedies to those who have insufficient means to pay for them, several notable advances have been recently made, and only need more general extension. Thus, in the terms of the advertisement announcing the competition for the Prize essay on the erection of "The King Edward VII." Sanatorium for Consumption, we find the second and third paragraphs running as follows: "The Sanatorium is intended for 100 Tuberculous Patients, 50 male and 50 female; of this total number of beds 88 will be assigned to *the more necessitous classes*, whilst 12 will be reserved for the well-to-do."

Again, in several towns, notably in London, Brighton, and Manchester attempts are being made to effect voluntary notification to the authorities of consumptive cases, and by this means to ensure prompt treatment of such cases in their earlier stages.

In London a movement is now in progress which advocates that provision should be made by some central authority—preferably the Metropolitan Asylums Board—for the open-air treatment of consumptive persons chargeable to the rates in the metropolis, and further, to enable the hospitals, provided primarily for the treatment of small-pox cases, to be utilised—during the inter-epidemic periods—for the reception and treatment of such consumptive persons. No doubt grave difficulties stand in the way of this latter reform, such as the possible recurrence of a virulent outbreak of small-pox, which might, however, be minimised by increased

attention to vaccination, but it is at least possible that by this means, and by advantage being taken of other surplus accommodation, some systematic and thorough treatment of consumption among the poorer classes might be effected.

It has been urged that this departure will prove an ultimate saving to the rates, while the action of the State Insurance Societies of Germany in establishing and maintaining Sanatoria for consumption is adduced in favour of this contention. Several County Councils have already taken steps in this direction, and in this good city of Bradford, I understand, that it has been decided to erect a Sanatorium for the consumptive patients of the Bradford Union.

It should not, however, be forgotten that in addition to pauper cases there are many working men and small tradespeople whose means are insufficient to enable them to pay for private treatment, and that it is specially needful that provision should be made for the treatment of the disease in these classes.

Before passing from this subject, I will refer shortly to a new discovery, or rather departure, of bacteriology. It has been known for some time that by attenuating the virulence of cultures of organisms producing such diseases as the plague, serums have been produced which render those inoculated with them immune against the attacks of the original disease, which would in most cases have proved fatal. But science never stands still. New appliances and substances are continually being discovered, and even liquid air is now being utilised by the bacteriologist. As we already know, the life-products or excreta of micro-organisms are inimical to the organisms themselves, and to that extent protective to the human being inoculated with them, but the substances contained in those products are in some cases irritants to the human body.

It would therefore be a great step if the life-juices of the bacteria could be extracted so that the active principle contained in their bodies could be utilised unmixed with the noxious excreta.

By means of liquid air pathological bacteria are now rendered brittle and can be ground up so finely that their cell-contents become accessible and can be extracted.

This highly valuable process of grinding up these minute organisms at a temperature of 200 degrees centigrade below the freezing point of water, has recently been exhibited at the Royal Society's Conversazione by Dr. MacFadyen and Mr. S. Rowland, and attracted the particular attention of His Royal Highness The Prince of Wales. It is too early

yet to prophesy what results this discovery may have, but I have ventured to draw your special attention to this process, because if the reasonable expectations which have been formed should be realised, such diseases as tuberculosis in its manifold forms will no longer be invincible, and will become curable even in the most advanced stages.

SEWAGE.

The growth of population and its increasing density, especially in our urban districts, make the question of the treatment and disposal of sewage more and more important every year, and the full solution of this much vexed and much discussed problem is undoubtedly one of the most urgent and important aims of sanitary science. The intimate relation of the question to the pollution of streams and rivers, and to the purity of our water supply generally, adds to its interest and importance.

The great advances made during the last few years by the bacteriologist and the sanitary engineer, coupled with the large amount of most useful evidence collected by the Sewage Commission, may well lead us to believe that we are at last in sight of a settlement of this question. A most hopeful sign in this direction is the fact that the commissioners in their third report, published last March, find themselves able to make several very definite recommendations of far-reaching importance—recommendations of such a nature that they must almost certainly lead to legislation in the near future.

The difficulty in many cases of procuring suitable land for treating sewage, or of obtaining it in sufficient quantity, has naturally concentrated attention on the problem whether by purely artificial treatment sewage can be so dealt with as not only to give off an innocuous effluent, but also to reduce the amount of sludge to, comparatively speaking, insignificant dimensions.

The commissioners, in their interim report published in 1901, expressed the opinion that "it is practicable to produce by artificial processes alone, either from sewage, or from certain mixtures of sewage and trade refuse, such, for example, as are met with at Leeds and Manchester, effluents which will not putrefy, which would be classed as good according to ordinary chemical standards, and which might be discharged into a stream without fear of creating a nuisance."

It is now claimed that artificial filtration gives quite as good results as filtration over land. This opinion was most definitely expressed by Dr. Sims Woodhead in his evidence before the Commission in 1898, and Mr.

W. D. Scott-Moncrieff, in his Presidential Address in March last to the Association of Managers of Sewage Disposal Works, explained his improved methods, by which he believes a full solution of the sewage problem is attainable. In his bacterial system of purification almost complete liquefaction of the sewage is obtained by the action of anaërobic bacteria so that the sludge is reduced to a minimum, and this is followed by the action of nitrifying organisms so as to produce a high state of nitrification. The effluent, therefore, in addition to being innocuous, contains nitrogen in a form most suitable for raising crops of fruit and vegetables. It is interesting to learn that these experiments are now being put into actual practice at Birmingham. Inasmuch as this process may be described as a highly artificial development of natural methods of purification, it is impossible to regard it otherwise than with interest and hopefulness.

Complaint has been made of the Commission for not having sufficiently concerned itself with the important question of the nature of a perfected bacterial plant, but for rather directing its attention to the presence of pathogenic organisms in the effluent. When the effluent is passed into a stream not used for drinking purposes, possibly the presence of pathogenic bacteria may have been too much considered. But if certain deadly diseases are due to the presence in the body of distinct forms of bacteria, any precaution to prevent their gaining access to water in any way used in connection with human beings can hardly be deprecated. The recent outbreaks of typhoid fever following on the consumption of shell-fish, especially oysters, point very strongly to the conclusion that sewage effluents containing pathogenic bacteria are able to cause dire effects on human beings when passed, not into a stream used for drinking purposes, but even into an estuary of the sea.

This matter, however, requires further scientific investigation, for the experts have as yet apparently failed to discover the typhoid bacillus either in the oysters or cockles actually examined by them, though taken from the contaminated areas. Dr. Bulstrode placed an interesting statement regarding the shell-fish industries before the Commissioners, who evidently are of opinion that they ought to consider evidence and come to a conclusion on the matter. And they are now taking evidence with regard to the discharge of sewage, sewage effluents, and manufacturing effluents into tidal waters. Definite and detailed evidence is no doubt very requisite, and without such, drawn from all quarters, including those very interested parties, the fishermen and dealers in fish, there is not much chance of legislation of a protective character being carried through

Parliament. The collapse of the Bill introduced into the House of Lords in 1899 is instructive from this point of view.

But in dealing with the sewage problem there is a most important practical matter which precedes the question of treatment. I refer to a matter of the greatest interest to the inhabitants of the West Riding of Yorkshire, viz., the passage of *Trade Effluents* into the sewers and their consequent mixture with domestic sewage. If, as my predecessor last year remarked, the Rivers Pollution Prevention Act, 1876, was practically a dead letter as regards prevention of impure effluents passing into streams; it has almost equally given rise to difficulty and uncertainty in regard to the admission of trade effluents into sewers supposed to be provided for by Section 7.

As you are all very well aware, since the last Congress met the Sewage Commission has issued its *Third Report*, and its importance can hardly I think be over-estimated. The Commissioners have paid special attention to this question of Trade Effluents, and have come to the conclusion that "while the existing law is apparently precise, the difficulties attendant on its application in any particular case render uncertain the position and rights of any particular manufacturer. One of the results of this uncertainty has been that the work of enforcing the purification of manufacturing effluents has been considerably hampered and delayed. Moreover, we find as a fact that the attitude of local authorities towards manufacturers has differed widely, and that many manufacturers have been seriously handicapped. From the table handed in by the West Riding District Councils Association, it appears that in twenty-nine of the districts represented by that Association in which trade effluents occur the Councils refuse to allow effluents to enter the sewers; in four they are admitted subject to conditions, and in sixteen are admitted unconditionally."

Such differential treatment of manufacturers is not only in itself unfair, but is to be deprecated on the grounds that it seriously hampers (if it does not, indeed, injure) trade, and interferes with river purification. The Commissioners believe that the only cure is to *alter the law*, and the alteration they recommend is that it should be "the duty of the local authority to provide such sewers as are necessary to carry trade effluents as well as domestic sewage, and that the manufacturer should be given the right, subject to the observance of certain safeguards, to discharge trade effluents into the sewers of the local authority if he wishes to do so."

This recommendation of the Commission was indorsed by a large majority at a conference of West Riding authorities held at Bradford on

the 21st of April last. Such an influential expression of opinion should do much towards encouraging the Government to legislate on the lines suggested by the Commission. The Corporation of Bradford, however, strongly dissents from the views of the Commissioners, and urges that all traders should be entitled to discharge their trade effluents into the public sewers upon terms which should be uniform and based on standards, and that in all cases provision should be made by traders for removing solids from, and regulating the flow of, the effluents into the sewers.

It may be questioned whether there is really so much difference between the Commission and the Corporation as the latter appears to think. The recommendation of the Commission has an elasticity about it which, in regard to so complex a matter, ought to be a strong point in its favour. Moreover, the recommendation of the Commission ought to be considered in connection with what the Commissioners add in the succeeding paragraphs. With regard to the safeguards referred to, they think they should not be provided by direct enactment, but should be the result of regulations by the local authority, subject to confirmation by a central authority. Under these circumstances they foresee that differences and difficulties are pretty certain to arise between manufacturers and local authorities, and to settle them some tribunal should be set up, viz., River Boards. The Corporation of Bradford apparently agrees on this point, for it suggests that the local River Board should be constituted the adjudicating authority in the event of disputes between local authorities and traders.

Whatever differences of opinion there may be as to the mode of dealing with the trade effluent, all parties appear to be quite content to make the River Board the tribunal of appeal in disputes between the manufacturer and the local authority. And the Commissioners are satisfied that the three River Boards already existing have done their work so well that they recommend the setting up of river boards all over the country. There can be no doubt it is only by the establishment of such boards, each practically conterminous with a watershed, that the effectual prevention of the pollution of our rivers and streams can be secured.

It is in this connection that the recommendation of the Commissioners to establish a *Central Authority* becomes so important. In order that their suggestions with regard to trade effluents may be successfully carried out, they consider such an authority essential, and unhesitatingly recommend its creation; whilst on differences as to trade effluents there would be an appeal from the River Boards to the Central Authority, that Authority would alone have power to deal with the important questions of the refusal

of a local authority to receive particular effluents into sewers, or to construct or enlarge those sewers so as to accommodate a particular manufactory.

If legislation is to follow the recommendations of the Commission, the setting up of this Central Authority will be of the utmost importance, for it will be the co-ordinator of the scheme of reform. It would form a new department of the Local Government Board, and its first duty as soon as set up would be to constitute river boards for suitable areas all over the country. In constituting them regard would be had to the following considerations:—

1. They should be created to enforce the Rivers Pollution Prevention Act.
2. Each should have jurisdiction over a whole watershed.
3. The area should be sufficiently large to secure skilled officers.

But the advantages of such a Central Authority do not end here, for it might exercise supervision and control over all important matters affecting water supply. Some of these you will remember were brought prominently before the Local Government Board in October last by a large and very influential deputation representing in addition to this Institute, the County Councils Association, the British Association of Waterworks Engineers, and the Underground Water Preservation Association. The deputation emphasised three points:—

(1) The pollution of rivers and other sources of water supply.
(2) The taking of water for sale outside the area of the supplying authority to the detriment of local interests in the areas from which it is taken.
(3) The waste of water.

Now these matters might very well be placed under the care of the Central Authority, which with the River Boards would afford a complete machinery for dealing with the whole question of the protection of water supply, for while the Central Authority would deal with the pollution of rivers, and the protection generally of the sources of water supply, the River Boards would inspect public water supplies, and report to the Central Authority any cases of dangerous pollution of such supplies.

Such would be this Central Authority, such its powers and functions. I have ventured to call your attention to it at some length, although doubtless the report of the Commission in which it is referred to is in the hands of all of you, because it appears to present a reasonable, practicable, and wide embracing scheme which may very well without much delay be made the basis of legislation which will take us a long step onwards, not

only in dealing with the question of sewage, but also in solving that even greater sanitary problem—how to ensure that our whole population shall be provided with an abundant, constant supply of pure, wholesome water.

Conclusion.

I must now bring these discursive criticisms and observations to a close. But before doing so, I wish to emphasise once more my strong sense of the value of combining voluntary and official effort in sanitary administration. My connection for the last two years with the Metropolitan Asylums Board has proved to me that this combination can be made to work most smoothly and efficiently. Again I would impress upon you, the advocates of sanitary progress, that the first duty which lies before you is to advance the general intelligence of the nation to a just appreciation of the supreme value of its chief asset—Public Health.

The sacred story tells us that "the last thing to be destroyed" will be death, and I do not suppose that hygiene will ever be able to banish death from the world. It would not be for the happiness of man if he could become an immortal upon this earth. But hygiene can, under proper conditions, make our lives here happier and more useful, and, given modern conditions of environment, the prolongation of human life will tend not to impoverish but to enrich the individual worker.

It is for hygienists to advance and maintain a high standard of sanitation throughout our empire, to open up the rich but malaria-blasted lands of America, of Asia, of Africa and Oceania, and if they can change those lands into the seats of a happy and a contented population, they will have done their part in teaching their fellow-men to fulfil the destiny for which they were called into being, namely, to replenish the earth and subdue it. Hygiene is the means by which the Creator has chosen that man should learn how to fulfil his appointed task.

You are bidden, then, to labour in no mean calling, a calling which is its own great reward. The work which you have undertaken, and in which I would urge you to persevere with constantly renewed effort, is indeed "wholly good; a work free from the error and frailty that clings to so much that we do; a work unselfish, devoid of wish of personal gain, and instinct with the love of man." *

Bonum certamen certate, cursum consummate, fidem servate; reservata est vobis corona justitiæ in illâ die.

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* Dr. E. A. Parkes on "Personal Care of Health.'

SECTION I.

SANITARY SCIENCE AND PREVENTIVE MEDICINE.

ADDRESS

By Prof. T. CLIFFORD ALLBUTT, LL.D., M.A., M.D., F.R.C.P., D.Sc., F.R.S.

President of the Section.

IF I might suppose that any passing sentiments of mine, delayed on their way to oblivion by the too facile art of the printer, had caught your eye, I would guess that you had invited me to occupy this chair to-day because of certain reflexions I have made occasionally on the adventures of modern medicine into the regions of the inception of disease. The most fruitful function of the modern pathologist is to guide and enlighten medicine in her travel from the mouths of the river of fate, where the dead are swept into the ocean, to their sources where they may be stemmed, diverted or dried up. With such reason as I can muster, and with such persuasion as I can wield, I have urged that we have tarried too exclusively among the corpses, and that we must betake ourselves more earnestly to track out the remotest causes of disease, its origin, and very beginnings. We must make for the watersheds of disease to discover the gathering grounds where the first miasms are bred; and we must watch with zeal the investigations of those pathologists who endeavour to detect the incipient deviations from the right channels of life, the little living hollows wherein the living rills are apt first to lie stagnant, and the banks where contaminations may ooze into them. And if we push out so far, reveal so much, and cleanse and canalise our vital springs thus early in their courses, and in their flow so continually that they run swiftly and directly, that no impurities gather in them, and that cure may be superseded by prevention, and medicine be banished by hygiene, the physician will contemplate his latter end with the stoicism, nay, even with the carelessness, with which we contemplate all destinies

which are far enough off. If I venture to smile upon the efforts of these Congresses to sap the foundations of any craft, it is, I assure you, with a smile not of incredibility and conceit, but of hope and welcome.

Some such thoughts as these, then, you probably anticipate from me to-day; and if I can gain your ear it will be by an endeavour to discuss one or other of these original sources of frailty and disease in modern life.

In a public address I delivered a short time ago I touched, but touched lightly and briefly, upon an argument which has been used for 2,000 years at least in derogation of the office of the physician, and is at this day not infrequently used, if not to his professional dishonour, yet in some measure to the discredit of the results of his calling. The reproach which, as I have said, has been made against us since the time of the Greeks, or even longer, is that a physician may be well employed in curing wounds, or transient inflammations or distempers, but that his interference, which might well cease here, is extended to the mitigation of incurable maladies, whereby not only are useless lives extenuated, and cowardly and introspective habits of mind engendered, but also—what is worse—the survival of bad stocks is promoted. In modern days we call upon Darwin, and declare that, under our fostering, feeble individuals survive who, if Nature were let alone, would be eliminated in infancy, and weakly families persist which, having less and less hold upon social advantages, would, under what are called natural conditions, die out.

This being so, the physician, if occasionally useful, is said to fulfil in the long run an evil purpose in society. Not rarely we see this assumption in popular essays on matters of health; we detect it when more or less veiled by decorous apology, or we resent it when thrust upon us with bolder assurance. That in particular cases our craft perpetuates invalid lives and gives occasion to the increase of unsound generations is unquestionably true—as it is true that the law may favour injustice, or religion engender hypocrisy. The influence in society which shall be purely beneficent, the activity which may work no incidental harm, are yet to be discovered; but we are accused not infrequently, implicitly or explicitly, of working harm on the whole—of doing a work which, however beneficent for a time, is on the whole false in its issues. It is admitted that for the consolation of mankind the physician is indispensable, at any rate for the present; but none the less we may discern the ill-concealed opinion of many social reformers that from a biological point of view no inconsiderable factor of deterioration is involved in the exercise of our vocation, and that the more liberty we get the more, no doubt, will personal suffering be mitigated, but on the other hand the more will competition be eased off and the more will the race be diminished in a physical or corporeal sense.

Now I will not stay to demur on the ground that the mercy of medicine, even when bestowed on the physically unworthy, may be twice blessed; that it may do more to bless the giver than it may harm by the propagation of the unfit; nor will I even stay to plead that in modern society, if not in all societies, there is room for mental gifts which may be housed in the frailest of tenements. With such arguments, valid as they are, we are not concerned at a sanitary congress; indeed, the more sagacious of our judges are ready to admit these demurrers in full, while denying that they avail to prove our innocence as protectors of the frail and the degenerate.

On this occasion we are concerned, it is true, with the flesh, not with the spirit, and, although no doctrine is more absurd than that for a sane mind there must needs be a sane body, yet we must confess that on the whole when sane minds are in sane bodies they should have a far better chance of being serviceable to the community. We will grant then that if our services, even while not debasing the spirit, yet contribute progressively, and substantially to a sapping of the frame without which the spirit works, we must look to the foundations of our craft. To manufacture mind we cannot pretend; even to purify and sublime it is not our calling; if, however, we diminish its physiological chances, if we cheapen its bodily gifts and instrument, we may well be called to account.

The theme then would seem to run thus:—That by weeding out the physically unfit, disease is ultimately beneficial to mankind. Now whether this be so or not, there is no doubt that until our own time disease has had a fairly free hand; its advocates cannot complain that its beneficence has been hampered by too many disabilities. During the last half century or so no doubt its range and variety have been curtailed, and the eliminating function has been traversed by many deliberate interferences; but if we look back into the past we may discover that the human race enjoyed quite surprising advantages in respect of elimination, and enquire what advantages it drew from them. I am not now considering the classical plagues which we shall all admit to have been rather too brutal in their methods, nor times of rapine and bloodshed, but the more gradual and thorough operations of homely infection, frustration and decay. In the biographies of famous men of the seventeenth and eighteenth centuries, to go no farther back, we perceive that the standard of old age, indeed, was much lower than at the present day, but the mortality among young persons would seem to have been enormous. There are no statistics to fortify the impression; but time after time it strikes those of us who have some bent towards history, how common it is to read that such and such

a one came of a large family, of whom only he and another or two survived. To quote instance after instance would prove little, but the memories even of my own youngest days strengthen this impression of great mortality among children. We used to hear of outbreaks of, say, scarlet fever, devastating families with a virulence of which, happily, we hear little in this day of sanitary reform. In the out-patient practice of my early hospital years a common mother's formula would run, "I have had as good as ten, but I've buried seven of 'em"; and the record was very often worse than this. The frequent death of infants and children was looked upon indeed as in the normal order of things; they mostly did die; and if the mother dropped a tear upon each little corpse as it was carried to the graveyard, the father and other persons of strong common sense felt it was a mercy the babes didn't all survive or households would be crowded out. "Poor little thing, it was better in heaven," was a common phrase, even in the mouths of the gentle, pensive and not very happy women who bore each other's burdens. Mrs. Moss, we remember, though she had eight children, "never overcame her regret that the twins hadn't lived"; but we suspect that Mr. Moss and Mr. Tulliver took a cooler view of the matter.

However, fifty years of a rising sanitary standard, of purification of conditions of life, of a formal inculcation of responsibilities moral and legal, have done much to change public sentiment and current standards in this respect; but influences less apparent but still more powerful than these are at work. Certain alterations in the material conditions of our people have been more effective than the higher ethics in exalting our sense of the value of life. By emigration our numbers of late years have been heavily diminished, and the loss has been of the hardiest individuals, of men in the prime of their lives; not only so but, for reasons into which I cannot now enter at length, our birth-rate far from increasing in proportion has been absolutely falling. Of the reasons of the falling birth-rate some are honourable, some are dishonourable; of the more honourable reasons is a desire to do better for the children, a desire which comes in part of the general rise of the standard of living. If there is much that is selfish in the abstention, if there be an unwillingness to bear the precious burden of child rearing, and a determination to enjoy's one's self at all hazards, it comes also of a higher sense of responsibility towards the child, a wish to do one's best for it, a sensible inclination to bring up one or two children well rather than to drag up a houseful of them under disadvantages and discomforts. If then in these precautions there lie many evils, such for example as the loss of the moral discipline and the habit of industry which grow up more surely in larger families, on the other hand there are many

gains, especially in respect of the mere bodily health which we have now under consideration. For one or two children the shares of food, clothing, fuel, and parental watchfulness and providence are larger than when these privileges are divided among eight or ten of them. Again, the mother may stint herself for her bairns, and but yesterday Dr. Noel Paton offered some proof that the fœtus is nourished from the surplus store of the mother, and that to pine the mother is—in animals at any rate—to reduce the weight of her offspring. Not only so, but there is a gain greater perhaps than this in the prevention of belated births. I have always thought that the institution of primogeniture in Europe was physiologically speaking, a mistake; if many antecedents make for the eldest child being the most vigorous, this tendency is on the whole more than counterbalanced by the difficulties of first labours; and I believe that as a general rule the second child, who is born more easily, gets a better start and develops better than the first-born. However this may be, there is no doubt that the last comers of a large family are on the average inferior, even very inferior, to their predecessors; not infrequently the mother is worn by child-bearing, nursing and domestic cares; and in a substantial number of cases both parents are past the heyday of their energy and vitality.

Thus far, in what I cannot call even a rapid sketch, but rather in a few jottings and suggestions, I have ventured to consider, if within limits, the birth of fewer children under improved conditions may be better in the end than a more voluminous birth-rate of children of which some may be of lower vital capacity, and many less watchfully reared. It may be urged, no doubt, that if thus the progress of population may be smoother and more humane, viz., that by mixture with lower values the mean may fall, with this argument I shall deal presently; against it is the experience that the evil conditions which kill some, mutilate or reduce others whose original capacity was high. Within limits then the more abstract Darwinian conception of a free fight among the innumerable competitors of an unrestricted birth-rate may contain less valuable truth for the sanitary reformer than a modified doctrine, corrected for the working condition of the twentieth century, in which co-operative providence may prove better than the chances of individual survivals.

And not only so; there is more yet to be said against the view of disease as a mode of beneficence. Let us grant for a moment a birth-rate of unrestricted volume, and with it the correlative safeguard of elimination of the unfittest; under such conditions what kind of help should we get, what kind of help in times past has been got, from disease?

It is too readily assumed by the cruder Darwinian that disease weeds us out with discrimination; it may be true that in the long run disease may prove to have fallen in the main on the weaklier members, but to prove this the run must be a very long one indeed; and it would appear to be too abstract a rule, one too remote in its bearings, to be of service as a guide to life. The factor of resistence, in the march of disease as in the fall of the tower of Siloam, may have some vitality; but this vitality is so much modified by what we call luck, by accidents of contiguity, and of other particular and temporary individual advantages and disadvantages, as to be negligible. The incidence of disease, if it be conditioned to some extent by the poverty of individual constitutions, depends also more or less upon accidents of exposure, upon fluctuations of personal health which occur even in the robust, and above all upon certain specific features in the bodily structure or certain specific crases in the bodily humours which govern affinities and aversions for the agents of disease. It is a matter of every day experience that persons of robust constitution may, and do, present specific susceptibilities for particular diseases, as many an infirm person exhibits a corresponding immunity; so that such affinities denote a peculiarity rather than a flaw in the organism. The guileless man and the peaceful man may well be the first to fall before the cunning or the violence of the enemies of society; but the most logical fanatic of social equilibrium will shrink from declaring that even a warlike society will be the better without the guileless and peaceful. The society will seek rather to banish wicked and violent men, and to protect its marches from hostile incursions. Elimination of the unfit by disease is then too rough a method of compassing the survival of the fittest, even if the most vigorous of body be regarded as the salt of society. The profits are remote and precarious, the cost instant, enormous, and inevitable. We shall do better to banish incidental disease, and to keep and develop our strong and our weak together for other conflicts.

Once more: disease does not kill only; too often, as I have hinted already, it maims or enfeebles, so that in a substantial—perhaps in a very large—proportion of cases it subtracts the patients whom it may ultimately spare from the sum of the vigorous and adds them to the sum of the relatively inefficient. And it is to this aspect of the problem that, as the climax of my address—if I may pretend to a climax—I would pray for your attention. Who are the maimed, the deformed, the degenerate, whose survival is, from a zoological point of view, to be deplored? Are these cripples the gifts of the physician or the pensioners of our war with disease? If in any large number our weakly members are

left as such by the passing shadow of disease, how can we distrust the labours of the sanitary reformer?

I have used the word disease hitherto with little qualification; if in much of what I have said I have suggested infectious disease, I have not defined this intention. But now I will confine my meaning more nearly to this sense, and in so doing shall leave myself still a field vast enough for our expatiation. In discussing the nurture of the young, indeed, what disease is not infectious disease? To put it a little less rigorously: may I not say that for them what is not incidental disease is almost no disease? To the infant incidental disease begins before birth; nay, may I not boldly assert that it may begin even before conception? Doubtless there are bad stocks among us—very bad stocks: stocks in which it is hard to trace the taint to incidental and preventible causes; but as our knowledge of infectious and incidential adversities grows fuller and more penetrating, the range of such causes is found to be broader and deeper, and our hopes of amending the national health by elimination of morbific agents, rather than of enfeebled or blighted individuals, grow clearer and stronger. Instead of withdrawing himself into the contemplation of disease as a cathartic potion for the purgation of society from the feeble and the maimed, the physician must endeavour to gain the countenance of the ruthless Darwinian—I give him for the moment the name he inscribes upon his sable flag—by making it appear more and more approximately true that if the physician can but carry prevention far enough back: back to youth, back to childhood, back to infancy, back to the womb—nay, farther and farther, back to parent and grandparent, even to the third and fourth generation, whose physiological and other sins have visited their children—the margin for essential frailty of pedigree might merge into extinction.

When Sir Frederick Maurice and other philanthropists outside our profession warn us that our people are degenerating, shall we submit to be told that medicine must bear some part of the blame; that physicians are sparing lives which had been better offered up to the Moloch of disease, and survive only to multiply a stunted folk, and to enable corrupt or debilitated parents? Shall not the physician proclaim again to the deaf, and to those whose malady is the not marking withal, that it is not only infectious fevers and the poisons of tubercle, of rheumatism, of syphilis, of alcohol, which often blight when they do not kill, but also the more insidious and therefore more pervading and more perpetual degradation of bad air, bad houses, bad household economy, and other bad or defective conditions of life which pervert the lines of natural development and take the bloom of the fruitage of successive generations!

On a previous occasion I have referred to Dr. Ballantyne's work on diseases of the unborn fœtus as a sign of the times; as an adventure into a sphere of preventive medicine none the less vital in the nurture of a healthy people for being obscure, and difficult of effective occupation.

You may remind me that in these speculations I may be treading upon the treacherous ground of the inheritance of acquired characters. To the best of my ability I would keep off that ground altogether; and, so far as I am aware, I am off it. My prejudices are against such inheritance. For example, in my young days the dalesmen of Yorkshire drank prodigiously; drank like the Scandinavian heroes whose descendants they are. By drink they damaged their own lives badly; those stalwarts whom nothing but the scythe of Time could mow down, lived to great ages in spite of the drink; they were bound for longevity and not rarely they made it: but the majority poisoned themselves by threescore. Yet I noted in them no deterioration of race; generally speaking, their youths maintained the same promise of great stature, of energy and of courage as their forefathers. My reflections are confined to the orbit of want, neglect, mismanagement and disease; but to this misery not only as it may affect the embryo, the infant, the child and the youth, stunting or perverting them, but also as it may taint the procreative functions of the parents, or find in certain stocks not otherwise unfit for life, a proclivity to particular poisons. Could we eliminate rheumatism, for example, we might find many a stock, now degraded by chorea and other nervous faults, as well as by heart disease, restored to a satisfactory standard of value; and so on for other extrinsic factors.

To proclaim that by preventive medicine we can improve all bad stocks up to the present mean value, and fertilise the good ones to be fruitful infinitely above the mean, is more than I have dared to suggest; but I do call upon this Congress to declare that Public Health will do it better and more permanently than Public Disease can do it; and to urge upon the common Darwinian to study his origins even more closely than he has done, whereby he may learn that even unfitness is not uncaused; and that it may be even more practicable and more economical to hunt for and discover its various causes than to look to blind and violent readjustments after the extrinsic degenerative causes have done their work. We have made no little way in the nurture of our children, and in the growth of our youth, since the bad old days, not very far behind us, when some rough counterpoise to unchecked multiplication was found in equally unchecked pestilences, epidemic and endemic, in vice and squalor, and in coarse and even brutal ignorance and indifference concerning the management of children, and in the coarse and thriftless cookery of both poor and middle

classes in England; conditions which did, and still do, a large work of elimination no doubt, but after a very blundering and imperfect fashion. But, be this as it may, we have committed ourselves to another course, we cannot rest where we are; we have far yet to travel, much labour to undergo. When we have gone through this travail, when we have tracked all the factors of degeneration to their sources, we shall then be in a position to let loose the dogs of disease upon the unfit, in so far as they remain.

In concluding this address I have one more argument to enforce. That privation and disease are fallacious instruments for the improvement of the mean standard of human capacity I have urged on the grounds, first of the indiscriminate and wasteful incidence of the mortality; secondly, of the personal detriment of many of the survivors, a detriment often suffered in childhood when even slight perversions are apt to multiply with maturity.

The farther argument I would employ is that for mankind now and henceforth competition is a rivalry rather of societies than of individuals. That a strong society implies strong constituent individuals is true, but is truth in a somewhat bald shape. It seems indeed that packs of wolves, of rooks, or of bees, keep themselves solid and efficient by very summary methods with impotent members; but in packs of men certain new qualities are generated, qualities whose usefulness in the conflict of peoples we must assume in all cases, as in some it is already comprehensible. If for instance, the usefulness of the fine arts be inferential rather than apparent, and if it be true for the moment that the highest personal ethics may be too delicate even for internal politics—a position I hesitate to accept, and too rare for foreign politics—a position I fear we must accept—yet it is apparent surely that in large periods of time these higher ethics are becoming more and more effective in both these fields. The solidness of brotherhood, the intimacy of compassion, the economy of purity, gentleness and temperance are transforming societies within; but these new qualities, as we may perceive if we look no farther than to the reluctance and humanity of modern warfare, are indeed already stretching their arms beyond the state to the comity of states.

And the growth of these virtues lies generally in mutual forbearance and succour, in social alliances and in common efforts; not in trampling out the weak, but in strengthening their steps, not in expulsion of the sick but in the avoidance of disease, not in vengeance upon evildoers but in the prevention of evil. To this larger strife Darwin himself would give us his countenance; of this new gospel the physicians of Preventive Medicine are among the prophets.

SECTION II.—ENGINEERING AND ARCHITECTURE.

ADDRESS

By MAURICE FITZMAURICE, C.M.G., M.A., M.A.I., M.Inst.C.E.,

President of the Section.

I MUST begin my remarks by thanking you for having called me to preside over this important section of the Sanitary Congress. Engineers and Architects have to take a very large share in carrying out the principles which are the object of this Association; and, I think, in nearly all sanitary developments we play a part, sometimes small, generally large.

By making me your President to-day you have placed me in a position of some difficulty. I have to follow your President of last year, Sir Alexander Binnie, and as I have already taken his place in another position, and have been more or less connected with him in engineering matters for many years, his ideas and mine must be first cousins to each other. The place of this year's Congress is, moreover, the city in which Sir Alexander Binnie for many years so ably filled the position of Water Engineer.

At first blush, therefore, it does not appear quite satisfactory that this section of the Congress should have, for two consecutive years, presidents who may have similar ideas. I have, however, consoled myself with the thought that the president's address is, after all, quite an unnecessary part of the section's meeting, and in fact bears the same relation to the actual work of the section as the *hors d'œuvre* at a dinner to the more solid and satisfying fare which follows. Perhaps at some future date the president's address may take the form of a benediction in which the work of the

section may be reviewed and criticised as a whole. If this should ever be the case, I shall be able to congratulate myself on having had the honour of presiding over this section in the old and easy times.

In considering what subjects might be suitable for a few remarks to you to-day, I naturally fell back upon the sanitary view of some of the engineering works in the construction of which I have been myself engaged or which are now under my control, and I hope you will not think me too narrow-minded if a number of my remarks refer to London work, as I have spent a large portion of my life working in that city.

In dealing with the various works which are administered by the governing body in London, one is faced with sanitary problems on all sides; but probably the one which has been most prominent during the last twelve months is the disposal of the London sewage, and before dealing with some other matters I will make a few remarks on this subject.

Owing to the deaths which have occurred at several places in England from eating shell-fish contaminated by sewage, public attention has been naturally and rightly drawn to the question of the disposal of sewage at several places, and London, among others, has not escaped criticism. The authority responsible for the disposal of the London sewage has lost no time in fully investigating all possible contamination which might occur from the methods now in use. Although the result of this investigation has been that it is improbable that any of the shell-fish in the estuary could have been contaminated by London sewage, still I am sure the London County Council will not rest satisfied until steps have been taken to make such an eventuality impossible.

About 1889 it was thought that the question of the disposal of the London sewage was settled for many years when the system in use at the present time—viz., chemical precipitation and the conveyance of the sludge to sea—was decided on. The installation of this system was immediately accompanied by a wonderful improvement in the Thames. Instead of the banks of evil-smelling filth which existed before 1890 in many parts of the river, banks of sand and shingle began to appear: and a journey from Westminster to Woolwich became a pleasant experience instead of one which, in addition to being unsavoury, might lay the seeds of illness.

If we consider what the system adopted in 1889 meant, it is not surprising that there should have been this great improvement. Previous to this date the crude sewage was delivered into the river, while now the precipitated sludge to the extent of 7,000 tons per day, making a total of over 2,600,000 tons per annum, is carried by steamers to deep water 50 miles below the outfalls at Barking and Crossness. The clarified effluent,

amounting to 230,000,000 gallons per day, is discharged into the river at the outfalls.

For some years this system was quite satisfactory, and until 1898 the condition of the river was as good as could be wished. The oxidising effect of the river water on the effluent is, however, dependent on the relative amounts of effluent and river water. During the last few years there have been abnormally dry summers, the water companies have been increasing the amount which they draw from the upper reaches with a consequent diminution in the flow in the lower reaches of the river, and the quantity of effluent has been increasing. With such conditions there must of necessity be a change for the worse in the river. At the present time the condition is satisfactory except occasionally for a few days in summer when the flow of the river is very small. This very short period during which the river water is not sufficient to oxidise the impurities of the effluent is, however, the danger signal which warns us that the time has arrived when further precautions must be taken so as to keep the river pure at all times. It must not, however, be assumed that the London County Council waited for this signal before considering what was necessary to safeguard, in the future, the health of the inhabitants of London. For many years continuous experiments on a large scale have been going on at Barking and Crossness on the bacterial treatment of sewage, a system which has passed the experimental stage, is coming into general use, and which will be dealt with by papers before this section; and I hope, in the discussion, the capital cost and working costs of different installations, as well as the amount of sludge got rid of in septic tanks, will be fully dealt with, as these figures are of the utmost importance.

The sewage of London has one advantage over that of many other towns in that it presents no difficulties due to trade refuse. The problem before London is to a great extent one of pounds, shillings, and pence. The first part of the problem is to have a system which, by sending the sewage further out to sea, or by treating it by bacterial methods, or by dealing with it in some other way, shall be effective. The second part is to have a system which is capable of gradual enlargement to meet the needs of a growing population. I have seen it stated that steps should be immediately taken to deal with all the London sewage on the bacterial system. Such a proposition, to my mind, is ridiculous. If bacterial methods were adopted they would be adopted gradually, and the river-water would still deal (and effectively) with a large amount of chemical effluent. London is not like an inland town situated on a small river which may run through several other towns. It has a tidal river with an average *fresh*-water flow of 1,200

million gallons per day. The river must be brought back to the condition of purity existing in 1894, and this will be done and probably be improved upon. I may say that during the last two years a capital expenditure of £700,000 has been made on improvements in the London sewage system, preparatory to dealing further with the question of the sewage disposal.

It may not be out of place to remark that it is not the sewage of London alone which enters the Thames. The river Lea and towns on the Thames, such as Gravesend, Southend, Sheerness, and Chatham, discharge large quantities of sewage, some untreated in any way. I hope in a very short time that the London County Council will be able to announce the steps which they propose to take for the further purification of the Thames, as it seems clear that—although whatever contamination there may be of the Thames is only partly due to London sewage—the Council, rightly or wrongly, will have a great part of the responsibility thrust upon them.

I should like now to make a few remarks on sanitary questions in connection with large engineering or architectural works. By such works I do not mean those which are the seat of a permanent industry, but such as are installed temporarily for carrying out large schemes.

I have had the advantage of being connected with many of the large works carried out during the last twenty years, both in this country and abroad, both in temperate and tropical climates, and I have been very much impressed with the necessity for proper medical attendance and sanitary supervision. Wherever large bodies of men are collected temporarily it cannot be expected that the cost of providing for medical and sanitary requirements on the same basis as would be adopted for permanent occupation can be incurred. Those, however, who are responsible for the works have a duty to perform, not only to the men employed, but to the general public. It may well be that a temporary camp of workmen, when proper precautions are not taken, may be the means of spreading disease far and wide among those in no way connected with the work. While, therefore, the sanitary and medical arrangements can only be of a temporary character, there is no reason why, if properly carried out, they should not be of such a nature as to allow all those employed to lead a healthy life, and to prevent any possibility of forming a centre for the spread of disease. I am sure in large works it is not only a duty which the contractor owes to his men and to the public, but one which, if he is at all far-seeing, he owes to his own pocket, to see that such matters are well looked after.

For many works it is not sufficient merely to put up dwellings for workmen and let it be known that men are required. Very often special means

have to be taken and special inducements given to get men on to works, and surely one of the greatest inducements should be that it is possible for them to lead a healthy life, with medical aid in case of illness and with proper sanitary surroundings.

For works of the largest class, where from five to ten thousand men or even more may be required within a small area, it is not enough to wait until an epidemic breaks out before taking measures to deal with it. Such outbreaks ought always be foreseen and provided for in such a way that immediate steps can be taken to isolate the victims and secure the safety of those liable to attack.

If in the case of large works operations had to be temporarily suspended on account of epidemic illness, and such a course has been necessary in some cases, the actual money loss incurred on that account would be enormous, and the amount which, if spent on medical and sanitary precautions, would probably have obviated such a stoppage, would be inappreciable in comparison.

I am glad to say that, as a general rule, contractors recognize what is to their own profit and do take the necessary precautions, both with advantage to themselves and to their workmen. I may mention two large engineering works, the Forth Bridge at home, and the Nile Reservoir, Assouan, abroad, where I am sure the execution of the work was facilitated and good relations between employers and men were attained by having medical attendance and sanitary supervision of the best kind.

In the case of the Forth Bridge medical attendance was always immediately available for workmen, whether living in the temporary houses provided on the works or in some of the adjacent villages. In the case of epidemic—and at one time there was the beginning of what might have been a serious small-pox epidemic—a large hulk fitted as a hospital was moored in the Firth of Forth, to which infectious cases could be at once removed. Of course, in the case of a work such as the Forth Bridge, or in fact almost any large work in Great Britain, there is generally a hospital in some adjacent town to which, in cases of great emergency, patients can be brought, and in most cases extra medical attendance can be obtained to help on the works in case of epidemic. When, however, large works abroad have to be undertaken there is, in very many cases, great difficulty in obtaining help in times of emergency, and the medical and sanitary arrangements have to be self-contained and ready to deal with any sudden outbreak of disease.

In the case of the Nile Reservoir Works, which I have already mentioned, the contractors very soon recognised the necessity of fully dealing

with the sanitary and medical question, and the means and precautions adopted were probably the most complete which have ever been undertaken on any public works. The stoppage of such works as those at Assouan, even for a very short time, might, at certain times, have entailed the loss of several hundreds of thousands of pounds. As nearly all labour had specially to be brought to the works, the Europeans principally from Great Britain and Italy, and the natives from Lower and Middle Egypt, it was most important that there should be nothing to keep labour away, and in fact it was necessary that the works should have a good name from the beginning. Small-pox and typhoid are endemic in the Nile Valley, and a large outbreak of either in a camp where 15,000 persons were at times employed would be disastrous. The contractors therefore at once built four hospitals, two large ones to deal separately with the European and native workmen, and two smaller ones to take the better class, British inspectors, and the engineering and general staff. Two wards for infectious cases were also built some distance away from all other buildings. Three doctors were employed, and a staff of 100 men under European inspectors dealt with the sanitary arrangements. Filtered water was supplied to all who would take it, and a large ice machine was obtained to supply ice to the hospital, and as far as possible for general requirements. Owing to the extremely high temperature during eight months of the year cases of sunstroke were common, and to enable these cases to be dealt with at once, hospital tents, with a plentiful supply of cooled water, both for drinking and immersing sunstroke patients, were placed at short distances apart throughout the works, and iced baths were always ready in the hospital.

A complete system of this kind was of course expensive, both as regards first cost and maintenance, but the total cost was an almost inappreciable insurance premium on the whole cost of the reservoir works, and when I state that only four deaths occurred from small-pox and one from typhoid during the five years while the works were going on, I think you will agree with me that it was money well spent.

I have, however, also seen works abroad where other counsels have prevailed, where no interest has been taken in workmen, where sanitary precautions were neglected, and where medical attendance was only obtained with difficulty. I have known men who have got ill or met with an accident on such works lying in bed in filthy huts for days without medical attendance, without proper food, without any sanitary convenience and absolutely uncared for.

It must be apparent that workmen recognise these differences themselves, and that those employers who look after the medical and sanitary

welfare of their men have not the same difficulty in obtaining and retaining workmen as those who take no trouble in the matter. I am glad to think that even abroad the latter employers are in a minority and, I hope, will soon disappear.

The question of locomotion in cities and towns is one which has been very much discussed lately, and to which I have personally devoted a good deal of time. This country, although until quite recently very backward as regards facilities for rapid locomotion in and about towns, appears now to be trying to make up for lost time. The provision of better dwellings and improved sanitary surroundings for the poorer classes is so dependent upon this question that perhaps a few remarks on the subject may not be out of place here.

I hope the time may come when a very large proportion of the working classes will think nothing of living six or seven miles from the place where they are employed, and will find that practically no inconvenience is caused by doing so. They ought on the contrary to be able to obtain larger houses and pay less rent than would be required for tenements in central areas; they would live in more open districts, and their families would be brought up amidst healthy surroundings. I know that owing to the cost of land is some of the business parts of London, the provision of suitable and healthy workmen's dwellings in such areas at reasonable rents is becoming more difficult every year. Mr. S. G. Burgess, the housing manager of the London County Council, has kindly given me some figures as regards the rents charged on some of the Council's estates in central districts and in the suburbs, which are very instructive. The rents charged for a three-room self-contained tenement in block dwellings on the Millbank Estate, Westminster, and the Bourne Estate, Holborn, vary from 9s. to 10s. 6d. per week, according to size and position. The tenements being situated in block dwellings, the tenants have necessarily no garden nor private court-yard. The rents, although high, compare with those ruling in the neighbourhood for similar accommodation; and in order to comply with the requirements of the Council's financial regulations, it is not possible to reduce them without involving an annual charge on the rates. On the three cottage estates which the Council are now developing in the suburbs at Tooting, Norbury, and Tottenham, three-room cottages will be erected that will contain similar accommodation to that in the block dwellings, with the addition that each cottage will have a fair-sized garden at the back and also a forecourt. The rents proposed to be charged for these three-roomed self-contained cottages vary from 7s. to 8s. per week. It will thus be seen that it will be possible for a family to reside in the

suburbs, and provided the head of the family can travel daily to his work at a return fare of 2d., or 1s. per week, he will effect a saving of 1s. to 1s. 6d. per week over the man in the central tenement, and in addition have the pleasure of a garden and healthier surroundings. As an illustration of how the cost of land affects the rents, it may be stated that in some of the central districts a tenant would have to pay for a five-room tenement 6s. 8d. a week to meet the interest and sinking fund charges on the capital required for the land, whereas in the suburbs the corresponding figure for similar accommodation would be 1½d. per week.

I cannot do better than quote the remarks made by the Prince of Wales when opening the first section of the London County Council's tramways last May: "I think that we are not dealing only with locomotion; it is also a question of health. By giving cheap facilities of access from the heart of the capital to the suburban districts you are removing the working classes from the scene of their daily toil, and from what are still too often insanitary dwellings, to healthy districts, where light, air and cheerful surroundings are obtainable." The exodus to the outer ring of cities and towns, even now very great, will increase according as facilities are given for rapid travelling at cheap rates.

In the larger cities, no doubt, underground railways, either tube railways or those carried just under the surface of the streets, will deal with what may be called the express local traffic. Such lines will probably in the future have their stations much further apart than those on existing lines, and an average speed of twenty miles an hour ought to be obtained.

In New York where—owing to the city being practically on an island and consequently not able to spread—the traffic problem is extremely difficult, four lines of rails are being laid under some of the main streets, two for express and two for slow traffic. The twenty-five miles of railway now under construction there will be one of the most complete systems in the world, and an object lesson to other municipalities in grasping and dealing effectually with an extremely difficult problem. It appears to me, however, that in addition to the traffic on underground or elevated railways, an increasing amount of traffic will be carried on the surface of the streets, either by electric tramcars or motor cars. I think, therefore, that in all our large towns increasing vigilance ought to be displayed in preventing any narrowing of roads by new buildings, and by taking every advantage to widen roads when buildings are pulled down. The gradual building of small houses for the working classes on the outskirts of towns has been accompanied, in many cases, by the formation of streets and roads of a

width corresponding to the size of house. This is a policy which will lead to great difficulties and expense later on. No one can say what the development of motor traffic will be, and to what distances outside towns electric trams will run. It is all the more necessary, therefore, to keep the entrances to our towns, and the country roads approaching them, of a good width, so as not to throttle the traffic at these places at a future date. I think there is nothing more important in connection with the provision of quick and rapid transit in and about the towns of this country than the widening of existing and the construction of new streets and roads. I have been engaged during the last twelve months in re-constructing for electric traction a large portion of the tramways in London, and this has brought particularly under my notice the number of narrow places in what are really main roads leading to the centre of London. In the case of tramways where the traffic is at all large and the cars frequent, it is almost impossible to carry on the service profitably, and at a high rate of speed unless there is a double line throughout. Those lines where there are frequent stops to allow cars to pass each other are comparatively unprofitable and very irritating to the passengers.

The development of motor traffic ought from a sanitary point of view to be encouraged. When it is considered that 45 per cent. of the dust carried by the air in streets is composed of organic matter, principally stable manure, it seems more than probable that a diminution in the number of horses in the streets must be accompanied by an improvement in the general health, or, at all events by a diminution in many of the throat and eye troubles so prevalent.

The provision of streets and roads of ample width, and the satisfactory maintenance of such thoroughfares, are the best means of encouraging the development of electric trams and motor traffic. Quick surface locomotion on wide roads may, I hope, do away to a certain extent with the necessity of spending an hour a day in tunnels underground—a penance which many of us who live in large towns have to endure, and which I am sure we were never meant and ought not to be called upon to undergo.

SECTION III.—CHEMISTRY, PHYSICS, AND BIOLOGY.

ADDRESS

By C. HUNTER STEWART, D.Sc., M.B., F.R.S.E.,

Professor of Public Health, and Director of the Institute of Public Health, University of Edinburgh.

President of the Section.

IN the early days of medicine, the effect of the environment on health was clearly recognised. Hippocrates, the Father of Medicine, in his work, "Concerning Air, Water, and Locality," insists on the importance of these factors in determining the character of the diseases which will prevail in a district, and points out that if these facts be known by a physician, he can "foretell the epidemic diseases of every approaching season and every year." Meteorological conditions he considered of the greatest importance, as "with the seasons the constitutions of men likewise change." The Greek physicians and their immediate successors considered hygiene to consist in the regimen of the six "non-naturals," viz., air, food and drink, rest, sleep, mental emotions, and the secreta and the retenta but during the middle ages, and even to the end of the seventeenth century, such views were almost if not entirely obscured by the wild theories and superstitions that then guided the practice of medicine.

The revival of the careful study of diet, of the conditions of inhabited localities, &c., in their causal and predisposing relation to disease, which so marked the eighteenth century, we owe chiefly to the teaching of Boerhaave and his followers. Indeed, from his time may be dated the introduction of the experimental method in these studies.

The cause of the phenomena observed in several acute diseases was referred to a fermentation of the blood and other fluids of the body. Two

factors were recognised as necessary for this process, first, an abnormal condition of the blood, &c.—the immediate or proximate cause; and second, the entrance of *contagions* into the body—the remote or exciting cause. These *contagions* might come from a previous case of the disease, or might originate from decomposing organic matter in the surroundings, and were by some supposed to have the power of self-propagation. But their nature being quite unknown, prophylactic measures were chiefly directed to keeping the body in a normal condition, *i.e.*, warding off the proximate cause of disease by attention to diet, regimen, and the general environment.

That infectious disease is a process analogous to that of fermentation is now accepted as proved. The brilliant work of Pasteur, Koch, and others has clearly shown that in the causation of both the intervention of micro-organisms is necessary. That later work has demonstrated that they carry on their functions frequently by means of diastases or toxins, produced sometimes within and sometimes without the protoplasm of their cells, does not affect the question, as such substances are only known as the product of micro-organisms growing under suitable conditions. From these discoveries the science of preventive medicine got a great impulse. The recognition of the micro-organisms associated with many of the infectious diseases, and the study of the conditions of life of these micro-organisms, have led to a more intelligent application of preventive measures. The "remote cause" of infectious disease, which had baffled previous efforts, can now be effectively attacked. The channels by which the micro-organisms gain entrance into the body of the healthy, and by which they leave the body of the sick, the conditions of their non-parasitic existence outside the body, and the means by which they can be destroyed or robbed of disease-producing function, are now studies of engrossing interest; and the facts ascertained regarding them largely determine the preventive methods which are now adopted with so successful results.

But is there not a danger that with so close an attention to the micro-organism we forget the other factors in the production of infectious disease? It can no longer be held, with Koch and others, that when a micro-organism of a known disease enters the body it necessarily produces that disease, as the comma bacillus has been found in the digestive tract and virulent bacillus of diphtheria has been found in the throat of perfectly healthy persons. Thus a bacillus capable of causing diphtheria does not do so in certain conditions of the body, just as in a broth culture of this bacillus containing acid the production of its toxin is either retarded or prevented.

Again, the virulence of pathogenic micro-organisms is not constant. When grown under certain conditions they may lose their virulence, and yet retain and possibly gain important properties, as was shown by Pasteur in his preventive inoculation against anthrax by attenuated bacilli. Later work has further shown that other properties of micro-organisms may similarly be removed, *e.g.*, the bacillus prodigiosus, by growth between 38° and 40° C., loses its characteristic power of producing its red pigment, while its power of decomposing sugar into lactic acid is increased. It seems no longer possible to apply the term "specific," at least in the same narrow sense as formerly, to the properties of micro-organisms, whether of disease, of fermentation, or of pigment production, but only in association with the conditions under which they carry on their functions, and—so to speak—their acclimatization to these conditions. Hueppe indeed affirms that there are no properties of bacteria more easily influenced than those which have been regarded as specific.

Among epidemiologists of the later half of the Nineteenth Century no name is more prominent than that of Max von Pettenkofer, and to him, in conjunction with Pasteur and Parkes, we may well attribute the foundation of the science of experimental hygiene.

The great mortality in the city of Munich from Asiatic Cholera and Typhoid Fever, the former in recurring epidemic and the latter in persistent endemic form, led him specially to study the causes and means of spread of those diseases; and the results of this study and the conclusions he arrived at and clearly enunciated have been incorrectly styled the Ground Water theory. More than the shortest outline of his views is here impossible, and the only excuse I offer for touching upon them at all is the hope of removing some misapprehension regarding them.

From a study of his great work, "Zum gegenwärtigen Stand der Cholera Frage," we gather his views. Koch's comma bacillus he considered the cause of Asiatic Cholera, and that it is contained in the bowel discharges of the sick, but in a non-virulent condition. To make it virulent certain external local conditions are necessary, and in the absence of these conditions extensive spread of the disease cannot take place. These conditions are present in a permeable soil polluted with fæcal matter, with a moderate degree of moisture and a suitable temperature.

The physical characters of a soil to which he attached importance are, (1) its permeability, that is the rate at which it permits the passage of air or water through it, and this is roughly in direct proportion to the size of its particles, and (2) its water capacity, that is the amount of water it can

retain in its pores by capillarity, and this is roughly in inverse proportion to their size. Districts situated directly on stiff clay he found to be unfavourable to cholera spread, and when cholera was found epidemic on clay soils they were found on examination to have such an admixture of gravel as made them approximate to permeable soils. The condition as regards moisture is that which is suitable for the growth of micro-organisms—not too dry and not too wet. In India, with its rain practically restricted to one season, he found the rainfall a suitable measure of this condition, and indeed in many of the districts there was no other available. The effect of rain in moistening a soil is of course dependent on the amount of rain and the water capacity of the soil—hence the same rainfall occurring in districts with soils of different water capacity will cause different degrees of moisture in these soils. In Europe, with the rainfall distributed over the year and varying in amount and time of maximum fall in places not far distant from each other, a knowledge of the rainfall of each district would be necessary. But in many districts there were no rainfall measurements made, and hence he had to adopt other means of estimating the moisture of their soils. In Munich and many other parts of Germany the level of the surface sheet of water, that is the ground water, depends on the local rainfall *only*, rising in wet and falling in dry weather. The fall of ground water level in dry weather is due chiefly to evaporation from the more superficial layers of soil, and the water thus removed is replaced to a certain extent by water rising by capillarity from the ground water sheet. As the ground water rises the layers of soil superjacent become wetter, and as it falls they become drier. If the water in a neighbouring river is in communication with the ground water, then the level of both will rise and fall together. In such circumstances changes in the level of the ground water give no indication of the amount of moisture in the superjacent layers of soil, as here these changes are produced, not only by the rain falling in the district, and which has to pass through the soil to reach the ground water, but also by the rainfall of a remote district whose water has discharged into the river. It was only in districts where the level of the ground water depends only on their rainfall that he used the changes in this level as a measure of the moisture of the soil above it. As he pointed out, the best way to determine the amount of moisture in a soil is in the laboratory by its loss of weight on drying, but since this is impracticable he used the rainfall, and in suitable circumstances the change in level of the ground water, as a measure of this condition.

Though Pettenkofer's views were chiefly developed in connection with

the spread of cholera, he applied them also to typhoid fever and epidemic diarrhœa, as he considered these diseases both in their mode of spread and their dependence on local and seasonal conditions very similar to cholera. He summed up his views shortly as follows:—"According to my view, for the origin of a cholera epidemic three factors are essential: (1) The specific cholera micro-organism, (2) the disposition of the individual, (3) local and seasonal disposition of the soil. Should one of these factors be wanting no epidemic can develop, and the severity of the epidemic will be proportional to the greater or less prominence of any one of them. It is a known fact that any process which depends on several essential causes does not occur when any one of them—it does not matter which—is absent; just as a chain breaks equally when one or several of its links give way. All preventive measures must be directed to these three factors."

Like nearly all other epidemiologists of the present day, Pettenkofer held that cholera cannot arise autochthonously in Europe, but is always the result of importation of the micro-organism from the East, either by a case of the disease or on the clothing of a person coming from an infected area. The micro-organism on the clothing might be virulent, and able to produce by direct infection a few cases of the disease, but could not cause an epidemic unless the local and seasonal disposition of the soil was suitable for conferring virulence on the micro-organisms discharged from the bowels of the sick. The non-virulent micro-organisms might however persist for months in the soil and set up an epidemic when the necessary condition of the soil was produced.

Pettenkofer did not aim at the establishment of any theory, but from a consideration of the observed conditions associated with the spread of the diseases he studied, he endeavoured to deduce reliable preventive measures.

As regards the disposition of the individual, the work done either by himself or under his direction and inspiration, on dietetics, on the need of pure air in dwellings and how this can be secured, on the nature and physical character of clothing material in relation to the warmth of the body and the healthy functions of the skin, and in many other departments, needs only to be recalled to show the general importance he attached to this factor in the causation of disease. But his views as to the conditions necessary for conferring virulence on the micro-organism of cholera, made the measures for preventing these conditions arising of outstanding importance. Since neither the physical characters of the soil nor the rainfall of a district can be altered, there only remains the prevention of the contamination of the soil by sewage matter with the consequent self-purification of the soil which sooner or later takes place, and this

constitutes his great preventive measure for cholera, and also for typhoid fever and epidemic diarrhœa.

In explaining his views he cites many striking instances of natural immunity of towns in which only a larger or smaller number of sporadic cases occurred, though they were freely exposed on all sides to infection by cholera. (In the case of typhoid fever, he found that towns might suffer from the disease and yet be practically immune as regards cholera). The City of Lyons and the town of Versailles are the most striking of these:

> In 1849, though cholera was epidemic in Paris, Marseilles, and Toulon, Lyons, with a population of 300.000, and a centre of traffic, had only forty-two deaths from cholera. In 1850 there were no deaths, though cholera was epidemic in Marseilles. The almost entire immunity which Lyons had enjoyed, led to an influx of population from infected districts during the epidemic in France in 1854; yet even in this year there were only 525 deaths, and these chiefly in one part of the town. In 1865 Marseilles had a severe epidemic, yet only eighteen deaths from cholera occurred in Lyons, and in 1866 its experience was similar. In 1884, while the most of Southern France was stricken with cholera, only twenty-seven cases occurred in this city. The immune portions of the city are built on granite. The portion in which most of the cases in 1854 occurred is built on stiff clay and gravel, its ground water is near the surface and rises and falls with the level of the River Rhone. In normal years the soil is too wet for favouring the epidemic occurrence of cholera. In 1854 a small rainfall occurred, the level of the river was low, and thus permitted a sufficient drying of the soil to make it to some extent favourable to cholera prevalence. In this way he explains the unusual number of cases which occurred in this year.

He considers Great Britain the most striking instance of acquired immunity. With a sea traffic from India greater than any other European power, in constant communication with the Mediterranean ports, and with no quarantine and cordon regulations such as prevailed on the continent of Europe, this country has, since 1866, known cholera only in the sporadic form, even though it was raging as an epidemic in France and Spain in 1884, 1885. This immunity he attributes to the great measures for sewage and refuse removal carried out in Britain, and which had slowly resulted in such a purification of the soil as to make it unsuitable for conferring virulence on the micro-organism of cholera. The micro-organism was imported, as the sporadic cases proved, but it fell on unfruitful soil.

As I have already pointed out, he observed that soils which were naturally immune to cholera were often not so as regards typhoid fever. He

adduces the experience of Munich, however, to illustrate the important rôle played by the soil in the etiology of this disease. During the period between 1848 and 1866 the average annual mortality from this fever was 2·24 per 1,000 population, while in 1880 it had fallen to 0·2 per 1,000. The sanitary measures introduced into the city were all directed to purification of the soil, *e.g.*, abolition of private slaughter-houses, concreting of cess-pools, drainage, and sewerage, etc., the new water supply being only introduced in 1883.

Pettenkofer's views have been much criticized. He himself looked to the progress of bacteriological work to elucidate many obscure points in the etiology of the diseases he studied. He did not advance his views as final, but based as they were on laborious epidemiological observation and inquiry he would accept no modification of them, which did not better explain the observed facts. On the other hand, to mere theoretical considerations he was quite indifferent, as is well seen in his relation to the diblastic theory advanced by Nägeli. Nägeli held that the soil exerted its influence on the predisposition of the *individual* by means of a micro-organism, and only when such predisposition was produced could the micro-organism of cholera cause the disease. The local and seasonal condition suitable for cholera-spread affected the virulence of the micro-organism according to Pettenkofer, the predisposition of the individual according to Nägeli, but both held it essential. Regarding this theory he says "I sympathize with Nägeli's diblastic theory, since it recognizes as necessary for the epidemic appearance of cholera in a place these two factors, which I have always emphasized, namely, the spread of a specific micro-organism through human intercourse, and the concurrent working of an influence from the locality. I would be glad to see his theory accepted and acted upon, as for practical measures it comes to the same thing, whether one views the process as monoblastic or diblastic, if one only recognizes the influence of the locality as an essential factor."

We now know that the comma bacillus, as it leaves the body, is, if not always, at least frequently virulent, and that the contention of Pettenkofer that cholera and typhoid fever cannot be spread by drinking water is quite untenable. On the other hand, the bacillus has been frequently found, generally in a non-virulent state, in the water, &c., of districts where cholera cases had occurred, in practically immune districts like Versailles, and also in the bowel discharges of perfectly healthy persons. According to Hueppe, indeed, the loss of virulence under saprophytic conditions, as in water, occurs more rapidly in pure than in polluted water.

Buchner and Gruber incline to a modification of Nägeli's diblastic

theory as best explaining local and seasonal incidence of cholera, while Metchnikoff thinks that it can be explained by the presence or absence in the intestine of saprophytic micro-organisms, which have the power of favouring or of retarding the growth of the comma bacillus when it gains entrance there. According to this latter view, which does not seem very different from that of Nägeli, the local and seasonal condition exerts its influence through favouring the existence of one or other of these classes of micro-organisms in the locality.

Few will probably disagree with Virchow in thinking the views of Pettenkofer too exclusive and uncompromising, still, at a time when bacteriology had made but small advance, they focussed attention on what seems a necessary link in the chain of cholera epidemic spread, namely, the renewal or increase of virulence in the easily attenuated comma bacillus.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

ADDRESS.

By THE MAYOR OF BRADFORD.

(Alderman David Wade, J.P.)

I FEEL that my first duty as Mayor of the City of Bradford is to offer a hearty welcome to those who attend this Conference of Municipal Representatives. In the second place, I must express my regret that the President of this Conference, Mr. Councillor Lupton, is unable to preside over its deliberations on account of illness, and I know that no one regrets more than he does his inability to take that position for which he is so well fitted. As municipal representatives, there is, I feel sure, a common feeling amongst us, for I have no doubt that everyone here is actively engaged in promoting some sanitary improvements in the district he represents. The representatives of the rural districts would like to stem the tide of the continued depopulation of these districts, and improve the conditions under which the agricultural labourer lives; and those from the urban districts would seek to find a remedy for the overcrowding which occurs to a greater or less extent in most, or all, of the great towns of the country. I observe with satisfaction that the question of the housing of the poor is one of the subjects which is to be considered by this Conference of the Congress. Probably one of the most useful ends attained by such a Congress as that in which we are now taking part, is the opportunity which is afforded to those engaged in municipal work of conferring with one another; for I believe that the best sanitary work is, and has been, done by municipal corporations, and in support of this opinion I will quote the words of Sir Albert Rollit. In his address to the Association of Municipal Corporations at the Guildhall, London, in March of this year Sir Albert Rollit said:—"What a splendid work has been done for the public health of the country! That has not been done by the House of Commons. The House of Commons has left its Health Acts in a most unseemly condition, scarcely capable of

reconciliation and interpretation. The result has been achieved by local work and local action, by local experience, by local knowledge, by local judgment; with the result that we have now the prime necessities of life in purity and plenty; that sanitary works are the crown of our public work, and that our confused codes of health have been built up from corporate action in our various municipalities, from experience, even from experiment, from success, from failures, for experience is the best teacher though the fees are high. They are splendid monuments of the public work of the nineteenth Century. They have not only reduced the death rate, but have enabled men and women to live healthy lives; they are a practical vindication of our municipal life." As a native of Bradford, and interested all my life in its staple trade, it has been a great pleasure for me to witness during the past forty years the great improvements that have been effected in the sanitary condition of our city. The death rate, which in 1868 was 28 per 1,000, has now been reduced to 16 per 1,000, the consequent saving in the number of lives being chiefly due to the sanitary works carried out by the Corporation. But it is not my intention to occupy much of your time; there are several interesting papers to be read and probably the discussion on them may prove to be protracted. Should it be the wish of the Conference I propose to limit each speaker other than the reader of a paper to five minutes, unless the Conference wish to hear any speaker at greater length.

CONFERENCE ON INDUSTRIAL HYGIENE.

ADDRESS.

By THOMAS OLIVER, M.A., M.D., LL.D., F.R.C.P.,

Physician to the Royal Infirmary, Newcastle-upon-Tyne.

PRESIDENT OF THE CONFERENCE.

(MEMBER.)

IN presiding over this Conference on Industrial Hygiene I feel that the only qualification I have for occupying the chair is my interest in the subjects to be discussed.

A hundred and one years ago the first Factory Act was passed. During the century there has been considerable progress in the sanitation of trades and the conditions of labour. Factory legislation exhibits the same fitfulness characteristic of all the political movements that have occurred in this country. It is made up of a series of disjointed Acts which successive Governments have tried to consolidate. Here, in Bradford, a centre of great commercial activity, whose products are known all the world over, is provided an opportunity for discussing the important questions of work and health. The public is taking an increasing interest in the manner in which industrial conditions affect the health and lives of the workpeople. While gratified at our commercial success it is well for us now and again to keep probing beneath the surface to ascertain at what cost to human life our national prosperity is sustained, and to learn something of the provision that is being made for future generations, so that Britain may successfully hold her own with other countries. Education is an important factor in the future of the

race; technical colleges will accomplish much, but these will be of little avail if our working men and women have neither the requisite physique nor the strength of mind and body. An interesting problem set us for solution, did time permit, might well be this: how far is the daily vocation of workers in the various factories in our densely populated centres favourable to their physical development; how far, on the other hand, is it hastening a degeneracy of the race?

The necessity for industrial hygiene is apparent when the death-rate of certain trades is scanned. Mere chance will not explain why file cutters, for example, die at an earlier age than farm labourers. There is something wrong, not necessarily inherent, therefore probably preventable, in a trade that causes workmen following that particular occupation to be shorter-lived than those employed in another. Otherwise how are we to make intelligible the fact, that for every 602 agriculturists who die, 1,516 cutlers, 1,702 pottery workers, 1,783 lead workers, and 1,810 file cutters die. The causes of the ill-health that leads to death under these circumstances too often reside in the occupation and manner in which it is carried on. Admitting this, can those trades that are acknowledged to be unhealthy not be made more salubrious than they are? To promote this end is one of the aims of industrial hygiene. To lighten the amount of sickness, and to lengthen the span of life to working men and women are objects deserving the support of all. It is the function of a State to provide for the moral and physical well-being of her people. Factory legislation is meant to promote this. It was never intended to cripple industries, but to place them on a higher level by prescribing conditions under which labour shall be carried on, and the health of the workers secured. The length of the working day, the age at which young persons and children shall be allowed to commence work, ventilation of work-rooms, women's and children's labour, women's work and pregnancy, the fencing of machinery, factory construction and the provision of fire-escapes, home industries and the consideration of certain trades that are scheduled as dangerous; these are questions that must be thought of in the larger one of industrial hygiene.

In Britain a century ago factory life, morality and labour were at a very low ebb. Working overtime and its attendant evils were rampant. It was no uncommon thing to find children of tender years working fourteen to sixteen hours a day. Sir Robert Peel's Act of 1802 reduced the working hours of apprentices to twelve, and regular night work for them was discontinued. The harrowing stories of the factory life of children at this epoch, and the hard conditions of labour during the two decades

immediately preceding remain a blot on the pages of the industrial history of our country. It was the employers and not the State that in those days regulated the hours of labour. To Robert Owen factory operatives owe a lasting debt of gratitude, not only for his humanitarianism, but for the fearless attitude he assumed in regard to the pressing factory problems of the times in which he lived. By not employing in his own mills children under ten years of age, and by gradually reducing the number of hours from fourteen to twelve, including one and a half hours off for meals, he demonstrated that by thus limiting the hours of labour the health of the operatives improved, and production was not diminished. Succeeding years have shown that the excessive amount of child labour employed in those days brought no wealth either to the nation or to the family, that it was the cause of great physical deterioration and of early death, that it hardened the hearts of parents and encouraged in them the false belief that they could barter for money the lives of their children.

OVERWORK.

Notwithstanding the progress made in factory legislation, it is only within the last two or three years that young persons have been prevented working two days and one night or more in succession at a stretch. The uncertainties of some trades, particularly those dealing with perishable goods, make at times no doubt unexpected demands upon the workers, but into a consideration of the number of hours worked there should enter the sex and age of the workers, the conditions under which labour is carried on, and the nature of the food which the purchasing power of the wages enables the workpeople to obtain. It should be borne in mind by employers that when the hours of labour are prolonged in all occupations beyond a certain point, not only is the character of the work done not so good, and therefore does not pay so well, but there are more accidents. In France the interval of four years permitted by the law of 30th March, 1900, to employers to gradually introduce a ten-hours' day has provided the opportunity of experiments being made in regard to this particular point, and of watching results without in any way disorganizing the industries. Naturally every employer wishes to get out of his workpeople as much as possible. In a Report presented to the International Congress for the Legal Protection of Workers held in Paris in July, 1900, M. Emmanuel Rivière states that if people work nine hours a day for a certain period, and subsequently ten, eleven, twelve, thirteen, and fourteen, it is found that up till nine hours a day the production per

hour is practically the same, but as the length of the day is increased beyond this, then in proportion as it is lengthened it is observed that the production per hour diminishes. After eight or ten days of longer working hours there is a progressive diminution in the daily production. Under all circumstances a sense of fatigue steals over most men towards the end of a day's work, more slowly if the worker is in good health, more quickly if he is already fatigued by the work of the previous day. His power of production decreases. It diminishes towards the end of the day in proportion as the duration of his work is lengthened; in addition, the workman is more likely to resume his labours on the following day with the sense of fatigue not entirely removed. The amount he therefore produces becomes less and less on each succeeding day, until after a certain period a condition of equilibrium is reached. The length of a working day cannot apparently be increased beyond a particular limit without entailing a loss. From an employer's point of view it is therefore undesirable to exceed the maximum of which a workman is capable. M. Grillet, one of the Factory Inspectors at Rennes, has had the opportunity in Brittany, owing to experiments made by employers of curtailing or lengthening as the case may be the hours of labour, of examining the pay-bills of several factories where the men are paid by the piece for different periods, during which the length of the working day had been 8, 9, 10, 11 and 12 hours. The experiments have convinced most of the employers themselves of the necessity from the industrial as well as from the social point of view of reducing and regulating the duration of work for adults. France, for the present, is aiming at securing a $10\frac{1}{2}$-hours working day for the factories. What the employers' experiments have demonstrated is that so long as there is no diminution in hours below a certain level, say 9 or 10 hours a day, the reduction in the length of the day has not been followed by any sensible diminution in the production, but that there has resulted from it sometimes a notable improvement in the quality of the materials produced. These results have been obtained, not only in factories where the work is done by hand, but also where it is done mechanically and where the workmen have had simply to superintend the operation of machinery. Here is one example:—In 1901 Messrs. Rollin & Morel, Shoe Manufacturers at Fougéres, ran their factory containing 250 hands 12 hours per day from Feb. 15th to March 15th inclusive. On the day of the official visit of M. Grillet, the Factory Inspector, the operatives were working only 11 hours. In answer to the question why this was so, M. Rollin replied, "our orders for goods are just as urgent, but on exami-

ning the amount of material produced, this is what we have found: for the first four or five days after the introduction of a 12-hours' day the production increased in a very sensible manner (perhaps one-eleventh corresponding to the increased duration of the work), but from Feb. 22nd, *i.e.*, seven days after, notwithstanding the day of 12 hours' work, the production fell so as to become sensibly the same as during the week preceding the experiment when there was only an 11-hours' day. I have gone back therefore," he said, "to the 11-hours' day." As the men were on piecework they were actually working one hour longer daily and yet receiving the same wages as previously. The extra hour did not help Messrs. Rollin & Morel's workmen, although it increased the expenses of the employers who had to provide artificial light, heat, motor force, &c. This experiment shows that over pressure of work can be undertaken, and that for four or five days, or a week at most, there will be an increased production, but after that time there is a declension.

I will take another example from the cases quoted by Grillet (Bulletin de l'Inspection du Travail, 1902, Numéros 5 et 6) viz.:—that of a factory in which 150 persons of both sexes are employed. The work is done by hand; it is the same all the year round, and is piece work. During August and September work was carried on for 11½ hours; during February and March, 1902, for 10½ hours; and during May and June, 1902 for 9½ hours per day. During August and September, when the day was 11½ hours, the wages received for 52 consecutive days were 117f. 10c., or 2f. 25c. per day: for February and March, a 10½ hours day, 126f. 90c. for 52 consecutive days, *i.e.*, 2f. 48c. per day; while for May and June, a 9½ hours day, 135f. 95c., or 2f. 61c. per day, were paid. In this instance the daily wages of the workers increased on each occasion that the length of the working day was shortened by one hour, the rate of wages remaining the same.

It is not for the moment contended that a man working 9½ hours can produce more than another similarly employed for 11 hours, but for steady continuous work carried on over a lengthened period it is maintained that the production of a 9½ or 10 hours work per day becomes in time equal to that of an 11 hours day. All that can be secured by lengthening the day is a temporary increase, and that is the point. An extension of the number of hours worked per day should only be resorted to when there is a spurt in the trade and then only for a limited number of days at a time.

It is scarcely within my province to generalize or draw conclusions from these experiments made by employers in France. I am contented to

state the facts which are based upon experience, and to leave them to employers and all who are interested in such problems either to confirm or refute them. That they contain a large element of truth is shown by the experience of coal miners in this country. The amount of coal a hewer turns out depends not so much upon the number of hours he is in the mine as upon his efficiency when at work. The output of coal is greatest in those mining districts where the hours of labour are shortest. The "quick stroke" of the Durham miner, setting aside for the moment the question of the hardness or softness of the coal, is according to Mr. Abraham, M.P., the effect of the shorter hours in the north of England collieries. A British Consul, writing from Germany, points out that in that country during times of pressure, overtime is often resorted to in the collieries, and that the men work a 12 instead of an 8-hour shift, but that experience shows the average production to be thus considerably reduced and that an 8-hour day of continuous work is the most that can be expected from a miner. The longer the working day, the more exhausting are the effects. In the coal mines of France and Germany the hours of work are longer than in Britain, and yet the production per miner is greatest in our own country. It would seem, therefore, that there is a limit beyond which it is undesirable to extend the length of the working day.

This question of work and fatigue is one that can also be approached from the purely physiological point of view. Drs. Zuntz and Schumburg, in their book "Physiologie des Marches," give in detail the results of experiments upon 5 healthy students who had completed their military service. At the end of the 28 marches all the 5 men had lost weight varying from 3 to 7lbs. The average march was 15 miles a day, and each man carried an increasing weight of baggage of 51, 63 and 72lbs. It was found that there was a rise of pulse which corresponded with the weight carried. One man suffered from excessively rapid action of the heart; his pulse rose to 130 per minute, and on one occasion he had arhythmia and all the signs of cardiac dilatation due to fatigue of the heart muscle from overwork. Another of the men suffered from brain fatigue with loss of memory. When the weight carried was more than 72lbs. there resulted a diminished chest measurement. Zuntz and Schumburg's experiments show that marching is beneficial when 63lbs. are carried, and harmful when the weight reaches 72lbs.

Having stated the subject of overwork and wages, also overwork and fatigue in this particular manner, let me now draw your attention to an injurious practice which, I believe, is on the increase in this country.

DRIVING OR RUSHING.

In the shipyards on Tyneside and at the North-eastern Ports, the system of "driving" or "rushing" is beginning to show injurious effects. In America, foremen are known to work men to the utmost of their capabilities—to an extent far beyond that in our own country. This system of "rushing" is finding its way into Britain; it is noticeable among platers and rivetters who are paid by the piece. Of the rivetters it is said they work so extremely hard—although the length of the working day is not extended—that by the sixth day of the week they are practically exhausted. They require, and they take, a longer rest, many of them spend Saturday afternoon in bed. I am not disposed, owing to the operation of other possible causes, such as the love of high wages and improper methods of spending their earnings, also the love of holidays, to attach too great weight to this statement of fatigue on the part of the platers and rivetters, but, on the other hand, I am in a position to state that the rushing in vogue at the present time is the cause of a certain number of accidents that are happening in shipyards. Especially is this the case among the young lads and unskilled labourers, who, while not receiving any financial benefit by being rushed, are yet obliged to incur greater risks through standing in dangerous places and through their movements being necessarily hurried to keep pace with the increased activity of the man at the head of the gang. The bad effects of "rushing" in piecework in shipyards are also observed in other occupations. This was recently brought to light in Lancashire, by the suicide of a girl at Darwen and the attempted suicide of another girl, aged 17, at Accrington, owing to the excessive pressure imposed upon them in the cotton mills, where the system of overwork is known as "driving." Since the speed of machinery in cotton mills has been quickened and production thereby augmented, so has correspondingly increased the demand made upon the resources and physical strength of the operatives who tend the machinery. From the newspaper accounts it appears that these two girls of rather more delicate constitution than most, had been bullied and threatened by the tackler on account of not obtaining the average production from the loom. In despair they resorted to self-destruction.

On all sides the tension of modern life is far too great, owing to the keenness of competition and the desire of wealth. If work instead of being a pleasure as it is to many people in health, and a necessity to most of us, is to become a positive evil whereby working men and women are ground down under a form of oppression so as to lose all taste for life,

then the sooner we resort to other methods of production and payment for work done the better will it be, not only for the individual, but for the race.

Ventilation.

The Factory Act requires that there shall be not less than 250 cubic feet of air to each worker, and during overtime, that it shall be 400 cubic feet, also that the employer must keep his factory and workshop reasonably warm without rendering the air impure. Every workroom must be sufficiently ventilated. The object of ventilation is the renewal of air without the creation of draught, also the maintenance of a requisite temperature. While introducing fresh air it ought also to remove that which has been fouled by carbonic acid, the organic matter given off by the bodies of the workpeople, and by the odours, fumes, and dust that rise from materials in the processes of manufacture Since in the larger workrooms there is a greater tendency for the air to become stagnant than in smaller rooms, artificial ventilation must be secured by means of fans. In dusty occupations the good effected by ventilation is apparent. Under its influence a dangerous trade can become a comparatively healthy one. Dr. Alexander Scott, of Glasgow, draws attention to fatal lead poisoning and serious ill-health occurring in women working in a room where wool dyed with chromate of lead was being handled, owing to the workpeople themselves stopping the running of a fan during the cold days of winter, also of the complete disappearance of plumbism when the fan was again started. In dusty trades more lives have been saved and more ill-health prevented by the Home Office insisting upon adequate ventilation than we can estimate. In cotton mills sickness has diminished, the health of operatives has improved, and the work has been accomplished with a greatly diminished sense of fatigue since the new rules regulating the amount of carbonic acid and moisture in the air have been introduced. Work carried on in an overheated or overhumid atmosphere is extremely fatiguing, and the injurious effects of breathing foul air for a lengthened period are known to all of us. The vital resistance of the individual is reduced, and he is more predisposed to infection. Medical opinion is divided as to how far the bad effects of breathing the vitiated air of close workrooms are due to excess of carbonic dioxide or to organic matter suspended in the atmosphere. Micro-organisms, although the exciting, are not the sole cause of disease. The state of health of the individual at the time he is exposed to the micro-organisms counts for much. Overcrowding in the home and in the workroom is an indirect

cause of pulmonary consumption. Under the influence of overcrowding, the vital resistance of the human body becomes reduced and tubercle bacilli become more virulent. The ravages of phthisis in our picked regiments in London a few years ago, and the practical disappearance of the disease since better ventilation of the barracks was adopted, supports this contention. It is in the ill-ventilated, badly-lit, overcrowded and overheated workrooms that the tubercle bacillus finds opportunities favourable for its development. The marked declension in the amount of pulmonary consumption in this country is due to recognition of the manner in which the disease is spread, and the inculcation of measures of personal as well as public and industrial hygiene.

Pulmonary phthisis is more frequent in some trades than in others. In very dusty trades, *e.g.*, pottery manufacture, the disease of the lung is non-tuberculous in the early stages; it becomes tuberculous by subsequent infection. In looking over the Annual Report of the Mount Vernon Hospital for Consumption and Diseases of the Chest for 1902, I was interested in observing the experience of this hospital as regards the incidence of pulmonary tuberculosis in certain trades and occupations. The figures show how, compared with out-door occupations, confinement in-doors and unhealthy environment act as predisposing causes of tuberculous disease. Of 465 cases that came under observation 80·03 per cent. were furnished by persons following in-door occupations and in-door trades, while out-door occupations furnished only 19·97 per cent. Of the in-door occupations, tailoring, printing, engine fitting, etc., supplied 26 per cent.; domestic servants, 15; shop assistants and dressmakers, 13; and clerks, typists and telegraphists, 9 per cent. As regards the out-door occupations, canvassers, agents, bus-conductors, coachmen and policemen formed 8 per cent.; soldiers and sailors, 2 per cent.; and bricklayers, labourers, etc., 9 per cent.

Dr. J. S. Haldane, of Oxford, with whose excellent work on the Air of Factories we are familiar, tells us that, roughly speaking, the amount of carbonic acid in the air of the open country is about 3 volumes per 10,000. In factories he found, in daylight, the average amount of carbon dioxide to be 10·1 volumes per 10,000, and in gaslight 17·6, *i.e.*, the amount of carbonic acid in the air of factories was 6 to 14 times greater than in the outside air.

The air in workrooms is vitiated by the combustion of gas, since each common gas jet produces $2\frac{1}{2}$ to 5 cubic feet of carbon dioxide per hour, also by the products of respiration, since 4 per cent. of the oxygen of the air is in expiration replaced by $3\frac{1}{2}$ of carbonic acid, and from 4 to 5 per

cent. of aqueous vapour is also added to it. Besides, during hard muscular labour, the amount of carbon dioxide given off by man may temporarily rise to ten times greater than during rest. The necessity for removing impurities in the air of factories by means of fans is called for, and as far as possible the substitution of electric light for gas. By means of fans, employers have, as a rule, no difficulty in providing the "sufficient ventilation" required by the Factory Act, which is that in no part of the factory shall the amount of carbonic acid be greater than 9 volumes per 10,000.

Excess of carbonic acid, and the presence of dust and bacilli in the air, are usually regarded as the causes of the ill-health and of the reduced vitality of people engaged in unhealthy trades or working in ill-ventilated rooms. That there is probably in operation over and above all of these, either singly or combined, some additional *materies morbi* is shown by the experiments of Ben and Rauer, who placed mice in a series of chambers fed by air drawn from one chamber to another by means of a pump. The animal in the last chamber always died first. Rauer believed that death was due to carbonic acid, but in the same experiments carried out by Merkel, modified by a quantity of sulphuric or hydrochloric acid being placed between the third and fourth chambers so as to absorb the organic matter, yet allowing the carbonic acid to pass onwards, it was found that the animal in the third chamber died first, while that in the fourth remained alive, indicating therefore that it was not carbonic acid that was the cause of death, but in all probability organic matter.

Women's and Children's Labour.

There are certain trades that are more harmful to women than to men in consequence of the injurious influence they exercise upon the child-bearing powers of woman. From such trades it is desirable that females should be excluded. The manufacture of white lead is one of these industries. Women if pregnant can scarcely follow their work in a lead factory without miscarrying; if they proceed to term, the children are born dead or they die shortly after birth from convulsions. It was knowledge of the greater susceptibility of the female to plumbism and the tremendous waste of infantile life that led me to recommend the abolition of women's labour in the dangerous processes of white lead manufacture. At the time that recommendation was made it was received with indignation, and it met with considerable opposition on the part of the manufacturers. It is pleasing now to know that since the Home Office

abolished female labour in the dangerous processes of white lead manufacture there has been very much less sickness in the works generally, that the extra cost of production anticipated in consequence of men having to be paid higher wages than women has not taken place, and that with the experience of the last five years to guide them the masters themselves say they would on no account revert to the employment of women in the white beds or other dangerous processes of the manufacture.

Say what we may, the problem of women's labour in all industries is very largely one of sex. Apart from physiological conditions that periodically interfere with woman during 25 to 30 years of her adult life, marriage of itself often prevents her following her usual occupation. The claims too of expected and realized maternity cannot be ignored. So far as childbearing and factory labour are concerned, the question naturally rises how long before the termination of pregnancy ought a woman to cease work in the factory and at what interval after having given birth to her child should she return to her occupation? In Britain a woman when enceinte is allowed to use her own discretion as to how long she should work. The Factory Act simply states that no woman shall be employed in a factory or workshop until four weeks have elapsed since the birth of her child. Many people are of opinion that one month after the confinement is too short. That is a point upon which this Conference might well express an opinion. Childbearing certainly knocks to pieces many of the factory hands. Some of the women are never the same after their first confinement. The extent to which the early return of the mother to work in the factory is a loss to the infant, and how far standing all day under these circumstances tending machinery destroys the future health and physical fitness of the woman, these are problems we cannot to-day stop to discuss. What concerns us is this. Assuming that intervention is necessary and that the length of the period of compulsory non-attendance at work after child-birth should be extended, then ought we not to see what provision can be made for the mother so as to allow her to remain longer away from the factory? A few weeks' additional rest from work would no doubt be good for the woman, and certainly it is best for the infant that in his earliest days he should receive the personal care and attention of his mother, but as a very large percentage of these women are, if not the sole bread winners of the family, certainly important contributors to its sustenance, we naturally ask ourselves: What is to become of the home if the weekly income is for several weeks longer altogether suspended or materially reduced? Immediate wants have to be met and often without monetary savings to accomplish it. In England

there is no provision made for poor working women during their confinement and after. Medical charities may relieve them of some of the financial burdens incidental to their condition, but even with this assistance the longer a woman remains away from the factory the greater is the loss in wages. The further extension, therefore, of the period of compulsory absence from work after parturition, which has been suggested by some medical men and politicians, is naturally resented by the women themselves and by the Society of Freedom of Labour Defence, &c., on the ground of the increased hardships which this would, if enforced, entail upon many a family. One of the ways by which this difficulty could be met would be by establishing benefit societies for this particular object, either on purely voluntary lines or state aided as in France.

It is a current opinion that there has been of recent years a marked increase in the amount of female labour in this and other countries. There are certainly more outlets for female enterprise and energy than there were a few years ago, and there is no doubt of the personal advantages these frequently confer, and of the relief they bring to congested homes where females preponderate, or where they are the eldest in the family. The recent census returns show that out of 13,000,000 women, over ten years of age, in this country, 4,000,000 are engaged in some occupation, while of 12,000,000 men, over ten years of age, 10,000,000 are engaged in occupations, *i.e.*, to say one-third of the women perform some work and five-sixths of the men follow some occupation. It would appear, therefore, that "the natural order of things has not yet become greatly disturbed by the alarming influx of women." They do not seem to have as yet seriously invaded male occupations. The substitution of female for male labour is favoured by the greater use of machinery. Against the increasing employment of women it is urged that their employment reduces wages, takes the women away from their natural duties which should be the home, and unfits them for becoming mothers. We have already alluded to the subject of factory life and maternity. It is common knowledge that factory work too often tends to cause anæmia in female workers, and loss of appetite, so that the individual is obliged to resort to articles of food that are savoury but less nourishing, although more expensive. A greater part of her earnings, therefore, has to be spent upon food that does not favour to the same extent the development of the body. Such a woman is scarcely likely to become the mother of strong, vigorous children, or to suckle them herself. Having lost her own taste for plain nutritious food, and indulging in expensive and savoury articles of diet, her children acquire, at far too early an age, the

same morbid appetite for artificial food as herself, and refuse to be fed upon that which is coarser and more wholesome. If women's labour in factories, etc., is thus becoming more prejudicial to their own health, and through them upon their children, then obviously the increasing employment of women cannot be helpful to the race. Yet what is to be done? The employment of women is widespread and is becoming more so. It would appear as if in almost every country where industrial processes have reached a high degree of development, women's and children's labour becomes increasingly sought after. As machinery becomes more and more perfected the greater is the substitution of women for men, a change considered by many as not always beneficial to the race, nor always satisfactory to the working classes themselves from a wages point of view. It would be interesting to determine how far increase of female labour in a country is to be regarded as a sign of advancing civilisation, or as a return to the primitive relations of an age long since past.

DANGEROUS TRADES.

It is in the dangerous trades that the good effected by factory legislation is particularly apparent. The notification to the Home Office of cases of industrial poisoning has been the means of saving much ill-health, since attention is at once directed to the circumstance of the poisoning, the cause sought for, and the defect at once remedied. Public opinion, as expressed through the press and in Parliament, has done much to promote industrial hygiene. It has been urged against the Home Office and the experts invited to assist in special inquiries, that want of practical knowledge of the trades in question has caused suggestions to be made by them which, if enforced, would seriously cripple trade. When, for example, Professor Thorpe, Dr. Cunningham and myself, pointed out to the English Government how improved ventilation, the greater use of machinery and attention to the teeth of the workpeople might prevent phosphorous necrosis, also that strike-anywhere matches were being made in France without white phosphorus, we were told that if our recommendations were adopted and enforced, the lucifer match trade of the country would soon be ruined. What is the position to-day? Not only has there been under the new rules, issued by the Home Office, a distinct diminution of phosphorus necrosis, and therefore, much pain and ill-health averted, but new methods of manufacture on the lines suggested have been introduced, so that in a large firm, like Bryant & May's, white phosphorus is no longer employed, sickness among the workpeople has disappeared, and such

a safeguard as the examination of their teeth, which the use of white phosphorus necessitated, has been abolished.

Surely in this we have an illustration of the good effected by the intervention of the Home Office. Manufacturers have been stimulated to adopt new and harmless methods of production and have improved upon old processes. But there is another indirect result of the substitution of the sesquisulphide for the dangerous white phosphorus in this country, to which attention has not yet been directed, and that is the very marked decrease in the number of fatal cases of suicide from the use of lucifer matches. By means of the ordinary phosphorus match a cheap and easily procurable means of self-destruction was in the hands of any person. To-day this is impossible with the sesquisulphide match. The internal administration of a solution in which 6000 sesquisulphide match heads has been soaked, is only followed by discomfort on the part of a rabbit; it does not kill the animal. A few years ago there was in Sweden, such a large number of deaths owing to pregnant women, in order that they might induce abortion, drinking liquid in which white phosphorus match heads had been dissolved, that it was proposed in Parliament to abolish the use of white phosphorus in that country altogether. At this date it was said that should such a suggestion be carried into effect, a serious blow would be struck at the export match trade of the country. To-day it is the law in Sweden that matches made from white phosphorus can only be manufactured for foreign consumption, and the result has been that while formerly a large number of deaths from phosphorus taken as an ecbolic occurred annually, death from this cause in Sweden has practically disappeared. Within the last few months the German Reichstag has passed a Government Bill prohibiting the manufacture of lucifer matches from white phosphorus. As a further illustration of what industrial hygiene has accomplished in the lucifer match trade in this country, the annual returns of cases of industrial phosphorus poisoning notified to the Home Office for the last few years are interesting. They are taken from the last report furnished to the Chief Inspector of Factories, by Dr. T. M. Legge.

	In 1899.	1900.	1901.	1902.
Cases	8	3	4	1

White Lead.

In no trade has the application of special rules been followed by more beneficial results than in those in which lead compounds are employed. The abolition of female labour in the dangerous processes of white lead

manufacture, the damping of the white beds to lay dust, improved methods of stoving, the means adopted to remove dust in packing, the direct mixing of the washed white lead with oil to form paint, the weekly medical examination of workers, their suspension on showing signs of plumbism, and re-examination before commencing work, have done much to diminish the dangers in white lead factories. For the 5 years ending June, 1889, *i.e.*, when white lead was made by the old methods and women were allowed to work unreservedly at the trade, there were admitted as in-patients into the Royal Infirmary, Newcastle-upon-Tyne, 135 persons suffering from lead poisoning, of whom 91 were females and 44 were males. There was an average of 27 in-patients every year, to say nothing of those who attended as out-patients. At that time not only was the larger number of the patients women, they were young women from 18 to 23 years of age. The death rate among these young females was simply appalling. I have seen young women die from the acute cerebral form of lead poisoning (encephalopathy) after having worked only 40 days, spread over 8 or 9 weeks, in a white lead factory. At that date they were allowed to work in the dangerous processes, viz., the stripping of the white beds and the making up and emptying of stoves. Public opinion was shocked by the far too frequent announcement in the press of the deaths of female lead workers. Under these circumstances a Departmental Committee was appointed by Mr. Asquith, then at Whitehall, to make enquiries and report to the Home Secretary. Since the recommendations of that Committee, upon which I had the honour of serving, have been given effect to, the number of cases of lead poisoning has very considerably diminished. In the last three years only 33 cases, 2 of whom were females, have been received into the Newcastle Infirmary, *i.e.*, an average of 11 per year, as against 27 a few years ago, and of these 11 all the patients recovered. Not only, therefore, has there been a very marked declension in the number of cases, there have also been fewer fatalities owing to the type of plumbism in the North of England having become less severe. If we take the whole of the lead industry of the country, the following are the numbers of cases of plumbism notified to the Home Office:—

Year	1899.	1900.	1901.	1902.
Cases	1258	1058	863	629

In the manufacture of white lead the following cases were notified:—

Year	1899.	1900.	1901.	1902.
Cases	399	358	189	143

These and other facts, which could be multiplied, are eloquent testi-

mony to the benefits which improved industrial hygiene has conferred upon workers in this particular trade.

Pottery Manufacture and Plumbism.

Although considerable attention has been given by Parliament and the public generally to the question of lead poisoning in pottery manufacture, I will not deal with the subject at any length to-day. The recommendations made by Professor Thorpe and myself to the Home Secretary, were met, as most of you know, by strong opposition on the part of the manufacturers. We recommended (1) a diminution of the amount of white lead in the glaze; (2) the advisability of fritting the lead so as to render it more insoluble, and (3) the substitution of leadless glazes wherever practicable. When Professor Thorpe and myself undertook the enquiry, the following were the numbers of persons suffering from lead poisoning in the potteries :—

Year	1896.	1897.	1898.
Cases	351	386	348

or 1085 cases in three years, of whom 478 were males and 607 females.

Of the total number of male persons working in the potteries, 4·9 per cent. became leaded, and of the females, who formed the smaller number of workers, 12·4 per cent. suffered from plumbism. Since that date partly owing to the introduction of Special Rules by the Chief Inspector of Factories immediately before our enquiry, and partly also to improvements instituted by the manufacturers themselves, there has occurred a distinct diminution in the numbers of cases of lead poisoning notified :—

Year	1899.	1900.	1901.	1902.
Cases	249	200	106	87

The improvement effected in pottery manufacture, as shown by the declining numbers of cases notified, is confirmed by the marked declension too in the number of fatal cases :—

	1899.	1900.	1901.	1902.
Out of a total of fatal cases in this country...	31	38	34	14
Deaths in pottery workers from lead	16	8	5	4

Here, again, no matter how the improvement in industrial hygiene has been effected, whether by the manufacturers themselves giving greater attention to details, or by the application of Home Office rules, the results are at once apparent as shown by the steady and progressive diminution in the number of cases notified and also in those that proved fatal.

GOLD MINERS' PHTHISIS.

On the outbreak of the South African War a large number of men returned to this country from the Gold Mines of the Transvaal, many of whom have since died from pulmonary consumption. These were gold miners, most of them still young and in the prime of life, who had gone to the Transvaal, not on account of their health, but to work, and who died within five or six years afterwards. Pulmonary phthisis develops chiefly in miners who are engaged in drilling the rock, or in driving a drift, occupations that are admitted to be extremely dusty. The freedom from phthisis enjoyed by the British collier, now extending over half a century, is justly regarded as the result of the improved ventilation of our coal mines. Time, however, was when coal miners died in large numbers in this country from disease of the lung called "anthracosis." During life the patient brings up in this illness large quantities of "black spit" and after death the lung is found to be perfectly black from particles of carbon and coal dust; it is also very solid from an overgrowth of fibrous tissue. We need not discuss how far the phthisis of the coal miner and the blackness of the lung are due to inhalation of particles of soot from his lamp, or to particles of coal dust. Both may act as irritants to the lung and induce fibrosis. Although a large number of gold miners were dying annually in the Transvaal, there is not the least doubt that had it not been for the South African War liberating these men and allowing them to come home, gold miners' phthisis would not have attracted public attention in England in the way and at the time it did. Several of the miners who have returned to Northumberland I have seen professionally, and I have had the opportunity of confirming by autopsy the diagnosis of this form of lung disease. Dr. John Dodds, of Cramlington, recently sent me a list of 33 men who had worked in the gold mines of the Transvaal along with one of his own patients, all of whom had died from phthisis. The majority of these men had died within five years service, and their ages varied from 25 to 38. Many of them succumbed rapidly to the malady caused by their occupation.

Six months previous to my drawing attention in the *Lancet* of June 14th, 1902, to gold miners' phthisis, a letter dealing with the same subject had appeared in the *Mining Journal* of November, 1901, written by Mr. Nicholas Trestrail. So notorious, he says, had the facts become in South Africa that enquiries had been instituted by the Transvaal Mines Department. According to tabulated statements of the inspectors of mines of the Johannesburg, Germiston, and Krugersdorp districts there

had been registered between October, 1899, and January, 1902, the following number of deaths among 1,377 rock drill men employed in the Witwatersrand:—

	No. of men employed.	Died.	Percentage.
Johannesburg ...	718 ...	124 ...	17·2
Germiston	454 ...	63 ...	13·8
Krugersdorp ...	205 ...	38 ...	18·5

In some of the districts matters were even worse, for one of the Mining Inspectors writes that the percentage of deaths varies in the different mines from 6·6 to 51·6. The general average of 17·2 per cent. dead in 2·5 years works out at an average of 6·9 per cent. per annum, and as the average mortality of healthy males about 35 years of age is, according to the mortality tables of the Institute of Actuaries, 0·8774 per cent. per annum, the mortality among gold miners is 7·8 times higher than that in any trade, including accidents and disease combined. The mortality is three times greater than that of Cornish metal miners, who have an unenviable notoriety for a high death-rate.

There are three possible explanations of gold miner's phthisis: (1) inhalation of the noxious fumes given off by the explosives used; (2) inhalation of dust generated during the drilling of the rock by mechanical appliances; and (3) infection by the tubercle bacillus. I am disposed to regard dust as the primary cause of the disease, and to acknowledge that as the malady advances it may subsequently become tubercular. To the *Mining Journal*, which has devoted considerable space in its pages to the elucidation of this subject, British and South African miners and mining proprietors owe a debt of gratitude. Following closely upon the attention given in the medical and lay press to this subject came the welcome announcement that a Commission composed of mine managers, miner's agents, and chemical and medical experts living in the Transvaal, had been appointed to enquire into the subject.

Woolsorters' Disease.—Anthrax.

We could scarcely meet in Bradford, the home of the woollen and hair industries, without making some reference to anthrax and its relation to local trades. Anthrax differs from other occupation diseases in so far as this country has, as a rule, nothing whatever to do with creating it: the malady is imported. The germs of anthrax come in the bales of wool and hair from foreign countries. What Bradford has to do is to render harmless, as far as possible, any material that is infected. Woolsorters'

disease is often extremely serious, rapid in its development, and quickly fatal.

In 1897 and again in 1900 special rules were drawn out by the Home Office. Good results have followed their application. Notwithstanding all that has been accomplished, the fact that the disease depends upon a specific micro-organism, the spores of which are extremely resistant to ordinary bactericidal methods, explains the ebb and flow of the tide of anthrax. Mr. W. H. Seal, H.M. Inspector of Factories for the Bradford District, has kindly supplied me with the number of cases of anthrax that have occurred in this neighbourhood during the last few years. In 1898 there were twelve cases, five of which were fatal; 1899, fourteen cases, four of which were fatal; 1900, six cases, two of which were fatal; 1901, three cases, all fatal; 1902, four cases, one of which was fatal.

As an illustration of the vital resistance of the spores of the anthrax bacillus, I shall mention one case taken from Dr. T. M. Legge's Annual Report for 1902, for knowledge of which, as well as for other valuable information, I am indebted to Dr. Whitelegge, the Chief Inspector of Factories. It is the case of a mattress maker who suffered from anthrax after handling hair that had been dyed and subsequently boiled for one and three-quarter hours. Dr. Legge mentions that as the result of experiments carried out by Dr. Klein and others, exposure to sulphur dioxide or to 5 per cent. solution of carbolic acid, while it destroyed other disease-causing germs, had no effect on anthrax spores; that a solution of corrosive sublimate, 1 in 1000 in twenty-four hours, destroyed anthrax spores and all other bacilli, also that exposure for one hour to 1 per cent. solution of chloride of lime disinfected the spores of bacillus anthracis on paper and linen, but not on wool or cloth. It is this extreme resistance of the spores of anthrax to ordinary germicides that explains every now and then the unexpected outbreak of wool-sorters' disease.

INDUSTRIAL HYGIENE.—OBJECTS.

The object of industrial hygiene is to render occupation as healthy as possible to the workpeople, to reconcile the health of the employed, and their physical fitness for work with the requirements of trade. New industries keep developing and with them fresh dangers to health. Industrial hygiene is only possible by the concerted action of the employed and the employer. There is a type of manufacturer who has the health and interests of his workpeople at heart, who keeps his machinery well guarded, the ventilation of his workrooms satisfactory, and whose regulations regarding methods of manufacture, so far as these affect the

health of the workers, are always in advance of the requirements of factory legislation ; the cleanliness of his workrooms is such that it inculcates by example principles of cleanliness and personal hygiene in the work-people themselves, and re-acts favourably upon them in their own homes. To such a manufacturer danger has only to be pointed out, either by one of his own workmen or by a factory inspector, for measures to be at once taken and a particular process of manufacture altered, or for hand work to be replaced by machinery. An example of this occurred only a few months ago in a large chemical factory. Immediately it was shown that the death of a second workman in the factory was due to the inhalation of particular fumes, a medical and chemical enquiry was instituted by the firm at its own expense, and attempts made to alter the faulty methods of manufacture. Employers can do much to promote industrial hygiene and protect the lives of their workmen. In at least one very large firm, on Tyneside, the number of accidents that occurred every year had been becoming so large, and the compensation paid to the injured workpeople so costly, that the employers appointed a special officer to look after structural alterations that were in course of progress, scaffoldings, the erection of new machinery, etc., and who was empowered to stop at once any work that seemed to him to be attended with danger. As a consequence of this supervision, there has been a very marked reduction in the number of accidents and a very great saving financially to the firm, a circumstance which carries with it the impression that a large proportion of accidents in factories is after all due to carelessness and thoughtlessness on the part of the workmen and therefore preventible. Just as there are exemplary employers, and careful and cleanly workpeople, so do we frequently find the opposite of these.

It is idle to expect benefits to follow unless both workers and employers loyally carry out the requirements of the Factory Acts. The responsibility of providing the means for making industrial hygiene effective rests primarily with the employers, but an obligation is also imposed upon the workpeople themselves. The risks of particular trades ought to be pointed out to those who are employed therein and how danger may be averted, the necessity of personal cleanliness, especially in taking food, washing, &c. The disastrous effects of alcohol, too, are either not understood by a large section of the working classes or they are voluntarily ignored. We shall never know how many of the accidents that happen in factories, docks, and shipyards are due to the influence of alcohol. In an age of keen competition that is taxing to their utmost the ingenuity of the employer and the skill of the British workman, we cannot too strongly point out

that alcoholic intemperance is fatal to all that is best in the work and endeavour of every man.

FACTORY LEGISLATION—RESULTS.

What factory legislation has accomplished no tongue can adequately tell. The thousands of lives that must have been saved and the number of fatal accidents averted we can scarcely even imagine. Each life that has been sacrificed at the altar to the Moloch of modern industry should be regarded as a vicarious sacrifice. The influence of such an event is not lost; the moral effects of such a catastrophe are far reaching, and ought not only to stimulate enquiry, but be followed by the device of means whereby occupation can be rendered healthier.

As a Nation we are justly proud of our commercial success, however doubtful may be our ability to retain the admitted supremacy. We look back with satisfaction over the long list of inventions which the British people have given to the world at large, and while many of these inventions may be described as of the nature of labour-saving machinery, they have conferred untold benefits by having augmented and cheapened production and by giving employment to a larger number of people. Behind all this, however, lies concealed something that is not so cheering. It is with industrial as in international warfare. Is it not when the battle is won and the shouts of victory ring in our ears, that for the moment we are apt to forget those comrades who have fallen in the fight? Beneath all visible signs of human activity, the sum total of which makes for industrial progress, there can be detected by the eye that chooses to penetrate the deeper recesses, a silent procession of men and women who have been worsted in the battle of life. It is for these working men and women whose health has become undermined by occupation disease, or who have been injured while following their employment, and therefore no longer able to earn their living, that we specially plead, not so much in the belief that we can restore all of them to perfect health or even to their own family, as that the lesson of their misfortune and suffering may be laid by us to heart, and the motto of all true sanitary reformers, "prevention better than cure," be fully realised, so that each man's work shall not only be a source of income, but one of health and pleasure to him. If the deliberation of this Conference on Industrial Hygiene can in any way further these objects, this Congress will not only have justified its existence, it will have conferred an enormous boon upon a large section of the population by helping the working classes to rise to an appreciation of higher and better things.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS.

By J. SPOTTISWOODE CAMERON, B.Sc., M.D., C.M., M.R.C.S.,

PRESIDENT OF THE CONFERENCE.

(FELLOW.)

SINCE the Conference of Medical Officers of Health, held under the auspices of the Institute in Manchester last Autumn, the attention of our profession has been specially attracted to one or two matters. Small-pox, which had been somewhat prevalent in London, has travelled, largely through the agency of tramps, through the populous North-west districts, to Lancashire, and thence to Yorkshire; and during the last eight or nine months the energies of the sanitary executives in these Northern counties have been largely taxed in grappling with this disease.

It has frequently happened to us in the industrial centres in the North, that after a long freedom from this disease a case has occurred in a lodging-house, sometimes in the person of a new-comer to the town who has been tramping in search of work from a district already infected. Occasionally it has happened that it is not the new-comer himself who first attracts our attention. He has perhaps arrived in our town without any very evident sign of disease upon him; has perhaps not considered himself much out of his usual health, but has slept in a common dormitory and occupied the common day-room in a doss-house, and some fortnight after his arrival three or four of his fellow-lodgers have developed unmistakable small-pox.

If the patient with small-pox were always very ill; if the eruption always appeared in the first instance on the face, our difficulties would be fewer. But it must have happened to most of us in the North within the last few months to have had to deal with one of these peripatetics who, notwithstanding the fact that our inspector has been daily visiting the the lodging-house and enquiring for anyone ailing, has yet escaped all notice, not only on the part of the keeper and the inspector, but even of his fellow lodgers. The irregular forms of small-pox are so apt to resemble cases of itch and eczema; so frequently does the eruption, notwithstanding the text-books, appear, to begin with, on the limbs and hardly at all on the face, that the first case not unfrequently is only recognised by enquiring backwards from one of its more typical consequents. It is an easy thing to send a man with a straightforward small-pox eruption into hospital, to disinfect the bedding in the room he has used, and the clothes of those who have associated with him in the day-room, but the unrecognised case has meantime been distributing his favours amongst his fellow lodgers, who have not only been going freely to their avocations in our own town, but who may have scattered themselves in their infected garments more or less over the neighbouring country during this interval of doubt.

Supposing one sees a suspicious case of this kind—a man with a nondescript rash on his forearms and thighs, who denies ever having had backache or indeed anything unusual—what is one to do with him? If the case be really one of small-pox one ought certainly to isolate him, but if the eruption is possibly a syphilide, and the man not immune to variola, to send him into hospital may give him the disease. The lodging-house has no separate room in which he can be placed, and there is no legal power of detention unless one is prepared to certify that the illness is indeed small-pox. An ordinary case of variola is easily enough distinguished by anyone at all acquainted with the disease, although cases of varicella in adults (and even sometimes in children) are frequently, and cases of measles, of syphilis, of pemphigus, and of scabies, occasionally reported to us as possible cases of small-pox. We do not complain of the hardship of having to see really difficult cases. Small-pox fortunately, notwithstanding all the efforts of the anti-vaccinators, is still a malady with which the rising generation of medical men is almost unacquainted, and it is only fair that those of us who have had larger experience in its diagnosis should be willing to help those who have had less. The greater difficulty is where we know nothing about the source of contagion until the disease has been already communicated to others, and we have to search back

three weeks or a month for the original mischief-maker. If he be still in our town, his symptoms have probably to a large extent disappeared, but if found we shall in all likelihood give the public the benefit of the doubt, re-vaccinate him and send him into hospital. If he has left, we communicate our suspicions by telephone and letter to all the places to any one of which we think it at all likely that he may have gone.

This sounds simple, but it often means a very large amount of work. Then in dealing with the other infected persons we may find that some of them have also left. Their whereabouts have, if possible, to be ascertained, and our colleagues in other towns communicated with. This also makes work—a great deal of it necessarily wasted. So long, however, as these people keep more or less to the regular doss-house, one can deal with them. The doss-house population is, fortunately, a little less susceptible to small-pox than the ordinary working-class population of the town. It contains a good many old army men who have been re-vaccinated. But when the man with a slight eruption on the trunk suspects that we have our eyes upon him, he often wishes to dodge us, and persuades some too generous chum to take him in for a night or two. The new case that he gives rise to is often more difficult to reach than if it had occurred in one of his mates in the lodging-house: the latter is, of course, under inspection. The lodging-house keeper is on the *qui vive*. Fellow lodgers are often willing enough to give our inspector a hint that so-and-so has got some suspicious spots about his back. But in the private house and in the unlicensed lodging-house, a patient, who has taken the disease in a mild form from our ambulatory friend, may never send for a doctor at all; may go about his work as a navvy the whole time, and occasionally, where he does call in medical assistance, the unsuspecting private practitioner may take a week to make up his mind what is the matter.

While, therefore, it is to the lodging-houses and to the casualty ward chiefly that we look for the introduction of the disease, it is in many respects more easily dealt with in these places than when it gets into the home of the working man. Fortunately, however, though the immediate result of the latter is a larger number of cases detected in our own town, the spread of the disease is generally more easily circumscribed once it is discovered. The householder and his family have not usually wandered off into other towns, although even this, so far as brother, son, or lodger is concerned, does occasionally happen. Is there any remedy? Many Boards of Guardians have wisely determined that all vagrants shall be medically examined. Many have adopted the cubicle system. Where both these

measures are in operation it is seldom that the disease makes great spread in that workhouse. It is not, therefore, desirable to make the place where these provident arrangements are carried out in other ways specially objectionable to the tramp. As a rule, this gentleman prefers company, and is not partial to the solitary system. Unless, therefore, the other workhouses can be brought into line, there is a certain danger of the avoidance of these more careful places by the fraternity.

The same is true in a minor degree of the better managed lodging-houses. The supervision by some keepers is so vigorous that comparatively few cases of small-pox enter their houses; but here also lies the danger, that if suspicious looking persons are turned away from the gate-house, they may find harbourage in the irregular lodging-houses already alluded to. The practice adopted in some towns, notably in Liverpool and Manchester, of offering a small fee to the frequenters of vagrant wards and lodging-houses to induce them to be re-vaccinated, has probably done something to check the spread of the disease. There is much to be said for it from the economic side. A man may possibly, if he uses his arm vigorously after vaccination, have to break time, and he cannot afford to lose the little wage he may get.

As already said, the following up of contacts is not always easy. Take one instance. A case was reported in a moderate sized lodging-house in Leeds: five men slept in the same room. When the case was reported the patient was at once moved, the bedding in the room disinfected by steam, the room itself stoved and cleaned down, and we were prepared to disinfect by steam the clothes of the other four men. Only three of them however turned up that night. We disinfected the clothes of these three and allowed them to continue their work, keeping them under observation, and paying their lodging-house fees for that purpose. Two of them afterwards, on or about the appointed day, developed the symptoms of small-pox, and were isolated before the eruption appeared, doing no harm to anybody. The third escaped attack, but of the remaining man, who did not return to the lodging-house, we saw nothing for many days. He was looked for in all the lodging-houses in the town by our inspectors, but as they did not know his face-mark, and as he had changed his name and altered his age by ten years, they failed to find him in any of the registers. Under his new name he came into hospital a fortnight later by way of one of our workhouses; but in the interval he had been living, in his infected clothes, in another lodging-house in the town, and of his mates, three, living in this other lodging-house, developed small-pox within a few days of

one another; one of them in the lodging-house, one in a friend's house in Leeds, and the third in another town, all three having apparently contracted the disease from him, *per fomites*, during his incubation period and several days before the development of his own eruption. Eleven other cases resulted from these.

Sale of Food and Drugs Act.

The inadequacy of the Food and Drugs Act has come pretty prominently before us during the last year. After a long sitting the Departmental Committee of the Local Government Board made certain, by no means too sweeping, recommendations as to the restrictions to be put upon the use of preservatives. Even these somewhat mild recommendations are not yet law.

The man who takes a glass of milk before breakfast, with or without the qualifying rum; who eats a couple of cured herrings with his buttered toast, followed, perhaps, by a piece of American ham for breakfast, is liable to get a fourfold dose of borax with these comestibles. Now borax although not an actual constituent of the human body, is, with many persons, comparatively easily got rid of. But there are some who are more susceptible to its action. Persons whose cutaneous elimination is defective, may suffer from a curious necrotic disease of the nails. In others the digestion is impaired by even small quantities of borax compounds. Yet the law, as it is at present administered, gives no protection to these persons who have been thus dosed with their particular poison unawares in their food.

The Margarine Act was a laudable attempt to protect the public from the substitution of an inferior compound for butter. The Food and Drugs Acts had been found so weak, that in the interest of the agriculturalist, who was apparently suffering from the too free introduction of foreign substitutes, what were intended to be very stringent regulations were passed to protect the public from having other fats palmed off upon them for butter. But through even this would-be effective Act the enterprising dealer has managed to drive his coach and four.

Margarine, for instance, is not exposed for sale and does not, therefore, require to have its distinctive label placed upon it if it stands on the shop counter behind a show-case. The retailer, who has had the substance invoiced to him as butter, is protected by the warranty of the invoice, and escapes a fine in the police court, while the man who gives the false invoice, when summoned, also escapes; for the invoice, which is a protective warranty so far as the retailer is concerned, turns out not to be a warranty

enabling the Authority to prosecute the middleman. Possibly the activity of the Board of Agriculture may give us fresh legislation, enabling us to deal with this palming off of margarine for butter. But after all this trespass is, from a medical point of view, of comparatively slight consequence. It is a mere fraud. The buyer is certainly cheated by having an inferior commodity foisted upon him. He is getting something for his money for which he would not give that price, but which has, possibly no very deleterious effect upon his digestive apparatus. He suffers prejudice by getting a cheaper article, when he is paying for a dearer one, and the intention of the legislature is distinctly to protect him. Its failure to do so is due to the evading cuteness of the vendor.

But if preservatives, or colouring matters, be used to make the article appear something which it is not—to make, for instance, preserved shrimps appear fresh shrimps, to make old peas appear young peas—it is doubtful, unless the drug be capable of producing dangerous symptoms in small doses, whether a conviction could be obtained against the adulterator. But surely the consumer has a right to be protected as much against boraxed shrimps as against chicory in his coffee, and as much against copper in his peas as much as against starch in his mustard.

Is it not time that all sophistications, whether for the purpose of preserving or otherwise, should require to be declared on the label? This would protect the susceptible person against copper and boric acid without preventing the person who prefers these ingredients from having them, if he wishes; while the Act, as it at present stands would, of course, penalize the rarer addition in large quantity of the more powerful poisons.

Education.

The introduction of the new Education Act has a special interest for medical officers of health. Our relationship with school boards throughout the country has been on the whole of the friendliest. Generally speaking there was no difficulty in getting a board to prevent the attendance of any suspicious case of infectious disease at one of their schools. The difficulty has sometimes been greater where, as used to obtain some years ago in some of the voluntary schools, the teacher farmed the grant. It was not always easy, under these circumstances, to persuade him that he would profit rather than lose by keeping away from school early cases of infectious disease, and the other members of a family where such illness had occurred. The action of section 101* had however helped us greatly in these matters, and we shall all regret to know that it has gone.

In future, with the county or borough sanitary authority responsible

entirely for all but the religious part of elementary education, it might seem at first sight as if health conditions ought to receive greater attention under their management than with *ad hoc* authorities. It is doubtful, however, how far this will be the case. The Education Committee may possibly be as really independent of the County Council as was the School Board, and it is doubtful whether they will in all cases, where they find the working expenses for non-provided schools, insist upon having these put into a proper sanitary condition in regard to lighting, ventilation, air-space, and all other respects before they take them over. Many of the non-provided schools are far inferior to the newly-built Board Schools; but even these are in many cases not what they ought to be, notwithstanding their having received the imprimatur of the Education Department. This subject, as you are aware, has already been discussed in the Society of Medical Officers of Health, and it is probable that we shall again have to make our voices heard in this matter on behalf of the public health.

Consumption.

Some little progress has been made in the matter of dealing with consumption. The site and architect of the King's Sanatorium have been decided upon. Authorities throughout the country have been bestirring themselves in the provision of places for the open-air treatment of the disease. Notwithstanding the startling pronouncement of Koch, dairy produce has been more carefully examined for the lurking germ of tubercle, and the notification of phthisis is coming to be looked upon generally by adventurous sanitary authorities as something desirable. The Local Government Board still bars the way and prevents our adding the disease to the list in the 1889 Act. Possibly the reason for this may in part be that the Prevention of Infectious Diseases Act of 1890 cites the diseases mentioned in the 1889 Act as those to which its penal clauses are applicable; and it has been generally felt that, in regard to consumption, it is not desirable to make the word "compulsion" too prominent in dealing with the relatives of persons suffering from this chronic infectious malady. It would, of course, be easy enough to stipulate that in adding the disease to the list in the 1889 Act it should not be consequently added to that of 1890. In the latter—and the same applies, I believe, to the corresponding portions of the London Act of 1891—it is stated that the provisions of the Act shall apply to the infectious diseases specifically mentioned in the 1889 Act, and may be applied to any other infectious disease, in the manner in which that Act may be so applied to any such disease. But it does not state that it must necessarily be applied

to any disease to which that Act has been extended, and which is not originally mentioned in the 1889 Act itself. It seems to me, therefore, that it would be perfectly legitimate, and perfectly legal, if the Local Government Board would only allow it, for the authority to extend the powers of the Notification Act to phthisis, without including that disease in the list of those to which the Prevention Act of 1890 is also to apply. There are other diseases to which it is perhaps advantageous that one of these Acts should apply and not the other. It is, for instance, desirable that, where the children have been suffering from measles or from whooping cough, the occupier should not quit a house without having it disinfected; but to punish this occasional lapse it is surely not necessary that the authority should pay the half-crown notification fee for every medically attended case of both these diseases.

It is I believe the case that clauses have been drafted in several recent private Bills to make the notification of phthisis compulsory, without making the patient and his friends liable to the penal sections applicable to breach of the law as to acute infectious disorders. They have I believe all had to be withdrawn. The objection to them, that they were local, would have applied with equal cogency to the original clauses on which nearly all our recent sanitary legislation has been founded.*

I hope the discussion on this subject, which forms an important item in the programme of the present Congress, may do something to clear the way and help us to get out of this rather ridiculous position. I shall not therefore detain you longer from the important matters set down for your consideration to-day.

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* Since this address was set up in type, the Local Government Board have, I believe drafted a clause intended to meet this difficulty. This clause will, I hope, be brought under the consideration of the Congress.

CONFERENCE OF ENGINEERS AND SURVEYORS TO COUNTY AND OTHER SANITARY AUTHORITIES.

ADDRESS

By T. H. YABBICOM, M.Inst.C.E.,

President of the Conference.

(Member.)

THE Borough Engineer has been ever ready to acknowledge the great help rendered by The Sanitary Institute in investigating the causes of those evils which, if allowed to continue, not only sap the vitality and energy of the masses of our population but in their acute stages sweep away the strong and able-bodied as well as the feeble and chronically weak. The Members of The Sanitary Institute are able to bring to their aid careful investigation, and oftentimes laborious research, in tracing an outbreak of disease to its source, and sanitary science is in the present day no empty word but a power for good in the hands of those who discreetly use it.

The Sanitary Institute, feeling that its labours are inseparably connected with municipal engineering, have of late years made a point of including amongst the work of its Congress a Conference of Municipal Engineers and Surveyors on subjects more especially connected with the prevention and spread of disease. At the date when the arrangements were being made for this present Congress, the writer was asked to preside at this Conference, being at that time the President of the Incorporated Association of Municipal and County Engineers, and he welcomed the opportunity of again meeting many of those friends who were so helpful to him during his year of office.

The members of our Association must be aware that nearly every duty

they are called upon to perform makes for sanitation, and must appreciate the help they receive from those members of the Sanitary Institute with whom they are brought in contact. The partnership is a very intimate one, and the actions of each may be beneficial to both, but it is well that from the outset the partners should recognise their own separate spheres of action without interfering with one another. It is the duty of the Surveyor to carry out works for his Council and to superintend other works constructed by private individuals under the bye-laws approved by the Council; he is responsible for the efficiency of their construction and for their maintenance in future years. As it is his duty to examine and report on the plans submitted for new buildings, and for alterations of the structure or drainage of old ones, so it is his duty to see that these plans are properly carried out. It was stated some weeks ago in a journal devoted to sanitary matters that the Local Government Board had been memorialized by certain Sanitary Inspectors to issue an order that it should be the duty of the Inspectors to superintend the construction of the house drains. It is not probable that such a memorial would be received by the Local Government Board with more than the smile of an indulgent parent for a petulant child, but it is an indication of the steps that some ill-advised persons may take in going out of their way to usurp the functions of others, and each member of the Incorporated Association of Municipal and County Engineers should take every opportunity of crushing in the bud any attempt to interfere with his obvious duties, as he, and he alone, is responsible.

It would be, not only tedious, but impossible, to traverse in a short address like the present, the many subjects where the Sanitarian and the Engineer meet on commmon ground, but at the present time there is one very prominent in the minds of men occupying responsible positions in our large centres of population; that is the problem of providing suitable dwellings, at a reasonable rental, for those now lodged in unhealthy tenements with sordid surroundings.

The legislature has decided, and very reasonably, that it will not grant compulsory powers for the acquisition and demolition of any considerable number of houses occupied by working men, and those dependent upon them, until provision is made for re-housing them at a reasonable distance from their work. Where the demolition of the old houses would be the result of a street widening, or of making a new street through a congested neighbourhood, the cost of making provision for the evicted inhabitants can be fairly well ascertained beforehand, and is so much added to the cost of the improvement; the authority can go to work with open eyes, having

made up its mind that the improvement will be for the general good and worth the outlay. In such cases the Local Government Board exact all that they are entitled to, and make no exception for even another Government Department, as a Bill promoted by the Post Master General for the acquisition of a site was withdrawn in consequence of the Local Government Board's representations, and the difficulties and expense of complying with the latter's requirements.

The Torrens' Act, Lord Cross's Act, the Act of 1882, and others were consolidated in the Housing of the Working Classes Act of 1890, to enable the Local Authority to deal with large and small unhealthy areas by clearing them of houses unfit for habitation, and constructing in their place dwellings complying with sanitary laws. As one of the causes rendering the clearing of the site desirable would be its congested state, it would rarely happen that the new buildings, having a greater superficial room area per person, separated by wide streets, instead of the former courts and alleys, could accommodate all the persons formerly living on the area, and the Act of 1890 gives the Local Authority power to acquire land elsewhere and make provision thereon for the persons unhoused. It may be assumed that the clearing away of unhealthy slums, with their hotbeds of disease, is a public benefit, and that, therefore, the cost of providing dwellings for those persons who have been unhoused is a legitimate charge on the public funds. An improved state of health must result in an improved condition of the mind, a sense of greater satisfaction with things in general, and better ability to perform work. Unfortunately experience shows that only a small proportion of the unhoused population of an unhealthy area find a habitation in the new dwellings. Persons who have sunk to the level of squalid, dirty, overcrowded rooms, do not readily appreciate light and airy dwellings, with the restrictions enforced by the municipal control, and are gradually absorbed in houses of the type they have been accustomed to, which in their turn become overcrowded, while the new dwellings built with the rates are occupied by a better class of persons than those for whom they were intended. Custom also largely influences the choice of a habitation and the wife of a working man does not take readily to a type of dwelling different to those occupied by her associates.

In many large towns there are, independent of the local authority, self-constituted committees for the better housing of the working classes who exercise sometimes an intelligent, and sometimes a sentimental interest in their protegés. These bodies press the local authority to put their powers in force even when it can be readily shown that the construction of work-

ing-men's dwellings in that particular district must entail a charge on the rates. In many places rows of houses have been built by the local authorities when the local builders were quite willing and able to supply all the accommodation necessary, and it is a doubtful point whether under those circumstances the council is justified in using the rates to compete with private enterprise, as there are very few instances where buildings constructed by, or for the council have been built as cheaply as those put up by local builders. The Local Government Board very rightly insists that the by-laws shall be complied with, but it also places upon the council the duty of providing expensive means of drainage and greater floor space per head of the persons to be accommodated than the occupiers have been accustomed to. Again, a block of buildings built by a contractor working under such a specification as the borough engineer must of necessity prepare, and under proper supervision in order that the specification may be carried out, will always cost considerably more than similar houses built by the speculative builder working at his own time and in his own way. Of course I do not refer to what are termed "jerry built" houses, but to those constructed of sound, useful materials, yet it is no unusual complaint made by members of a council that a house built by a private individual, and providing all the accommodation found in one of those erected at the cost of the public funds, can be purchased at a much lower rate than the cost of the latter. For these reasons very few of the municipal schemes can show a clean balance sheet at the end of the year even when the houses have been recently built, and if that is the case when they are new the result may be financially serious when considerable repairs have become necessary.

During the last few years the rates of most towns have shown a tendency to increase as better provision is demanded by the public for its comfort, convenience, and amusements as well as for the necessaries of life. Municipal debts have increased by leaps and bounds, and it is our duty that as tenants for life we do not leave to our successors a burden of mortgages too heavy to bear.

I take it, therefore, to be the duty of the municipal engineer, while desirous that his council shall occupy a foremost place in the advancement of all those points which make for the well-being of the people, to use his influence to discourage chimerical schemes for the lifting of a stratum of society that, do what you will to buoy them up, will always sink to the bottom, and leave the advantages offered to them to be reaped by other strata capable of looking after themselves.

CONFERENCE OF VETERINARY INSPECTORS.

ADDRESS

By CHARLES DRABBLE, M.R.C.V.S.,

President of the Conference.

MY first duty is to extend to you a hearty welcome to the City of Bradford. I trust we shall have a very successful meeting, and that through your deliberations not only this city but the community at large may benefit therefrom. I am almost at a loss how to address you, so will content myself with generalising on Veterinary Sanitary Science. Only in quite recent times has the public fully recognised that the veterinary surgeon occupies a small but important part in the protection of public health.

For some years past the annual Congress of The Sanitary Institute has afforded an opportunity for the discussion of some of the special sanitary subjects which the veterinarian is most closely connected with. The close connections of the subjects with the general science of sanitation and hygiene will perhaps be made more convincing if I refer very shortly to what has been done.

More than once at their meetings has tuberculosis in the domestic animals been discussed and stress laid upon the importance of the disease in relation to meat and milk. Since Koch expressed a doubt as to the infection of man by means of the bovine bacillus, less importance has been attached to the disease by many persons.

Fortunately many scientists and some pessimists have recognised the necessity of arriving at the truth, and experiments are now being carried out with a hope that some settlement of the question may be arrived at. Meantime we must wait patiently for the result of the research, but we

cannot overlook what has been done. Whether the bovine disease is dangerously infectious to man we may accept as a disputed point, but whether the human disease is infective to calves and other animals is beyond dispute. It may not be logical to conclude that because a disease is communicable from the human to bovine it must also be communicable from bovine to man. But in the absence of proof to the contrary it behoves all authorities to protect the population against possible danger.

Supposing Koch's dicta to be supported by the researches now in progress, we get rid of what ought to be a strong argument in favour of action being taken to control tuberculosis in domestic animals. If the bovine disease is really acutely dangerous to man, it is inconceivable that a determined effort to suppress it should not be undertaken by Government. But whatever result the Royal Commission may arrive at, there is still sufficient reason for an attempt being made to control the disease amongst animals. Meat is essential to the life and health of our population. A disease which causes great loss to stock owners should not be left to pursue its destructive course.

Another important part in connection with bovine and porcine tuberculosis is the loss sustained by butchers. Seizures of diseased carcases take place every day; and the butcher who has purchased an apparently healthy bullock, or cow, or pig, is unjustly penalised by its seizure—after death has disclosed a condition quite unsuspected.

Surely if anyone ought to suffer loss for the presence of disease it is the person who sold to the butcher the diseased animal. To call the butcher's loss a "trade risk" is only to express half a truth. Loss by fire, water, or accident is a trade risk properly named because unavoidable. The presence of contagious disease is not unavoidable. Latent defects in machinery cause accident, and are accepted as trade risks because they are not apparent and cannot be detected. Tuberculosis is a "latent defect," but it can be detected, and the stock owner is able at small expense to detect the disease before he sells to his butcher.

The matter of payment of compensation to a butcher for his loss entailed in having a carcase seized may, by some people, be called a controversial question; but in my opinion all the arguments are in favour of the butcher. Losses inflicted on individuals for the public good, when the loss is not due to any fault of the victim, should be shared by the public. The butcher, I believe, would not ask for the full value of his property. He would welcome a fair compensation.

At the present time our laws provide for the protection of milk consumers against the supposed danger of tuberculous infection in milk. The

regulations are clumsy and incomplete. A cow with a tuberculous udder may be compulsorily removed from a cow shed; but there is no law to prevent its being sold, and thus finding its way to another cow-shed where it may not be discovered for some time, if ever. If, instead of relying on the insufficient regulations of the Dairies and Milkshops Order, the diseases in cattle were scheduled even in diseases of animals acts, the proceedings would be safer and surer, and "wasters" and "piners" would be attended to as well as the cow with local signs of disease in the udder.

Other diseases dangerous to the life and health of man have been before these congresses. It has been pointed out that rabies, glanders, and anthrax, which are most fatal to human beings, can only attack man by transmission from diseased animals. So far as rabies is concerned, the Government has recognized that the only way to protect man is to stamp the disease out amongst animals. Rigid rules have been enforced and the disease has disappeared. I believe it is five years since a human life was lost from hydrophobia.

Glanders still prevails widely, and human lives are sacrificed every year to this horrible disease. The only reason why glanders exists is because the Board of Agrlculture has not yet learned what is necessary for its eradication, and because the medical profession and the public bring no pressure to bear on the Government authorities. That this disease might be easily and rapidly stamped out is the opinion of the veterinary profession, and that nothing is done by the Board of Agriculture is a sample of departmental inefficiency.

Anthrax is another disease which kills human beings. The prevalence amongst live stock in this kingdom is being permitted to increase, and I incline to the belief that its increase is due to repeated introductions of the disease from abroad. Outbreaks have been directly traced to imported manures, to imported feeding-cakes, to more than one cargo of imported oats, and we all know that the disease is imported in hides, wool, and hair.

As a townsman of Bradford I should be the last to suggest the enforcement of regulations against imported raw material necessary for trade. If a trade affords a livelihood to thousands it would be absurd to strangle it by legal enactments because a fractional percentage of workers might be injured or killed by it. The greatest care is now taken to protect those who work with foreign wool, hair and hides. There are two suggestions I venture to make.

(1). That the refuse of all manufactories which may be infected with anthrax, should be thoroughly disinfected before being mixed with manure and taken on to farms.

(2). That where it is known any foreign port sends us repeated supplies of infection, that port should be scheduled and treated just as is a port from which "Foot and Mouth Disease" is sent. Just as it is important that disease in animals should not be allowed to be transmitted to man, so is it that diseases of man, with no connection with animals, should not be charged to the animal. There is an idea that some diseases of man may be due to conditions in animals not recognised by the veterinary surgeon. When evidence is adduced of this it will be time to take action, but so far we know of no facts to warrant the statement that any domestic animals suffer from any disease not recognised by veterinarians which can be transmitted to man and give rise to a specific malady that the casual organisms of disease may obtain access to milk after removal from the cow and cause fatal epidemics in the human subject, is a fact. That a cow, suffering from some unrecognised malady, may infect its milk and thus cause a definite disease in man, is not a fact.

My reason for inserting this is, that great injury may be inflicted on the owner of cows if action is based upon this theory. In 1878 an outbreak of scarlet fever in a northern suburb of London, was really credited to the cows on a certain dairy farm. The supply of milk was stopped, the dairyman was put to a loss of £1,000, and so worried, that he died next year. The investigations made into this case by the veterinary department of the Privy Council, showed conclusively that the cows had only suffered from cow pox, a well-recognised and very harmless disease. For years after the issue of the veterinary departments report, no more was heard of this very unfortunate theory, but I notice that in May last an outbreak of disease (see *British Medical Journal*, May 23rd, page 122-5) in Sheffield was laid to the charge of the cows and this pathological error revived to account for it.

We veterinarians desire to give all the assistance we can to prevent the spread of disease of animals to man. We also desire to protect our clients, the stock owners, from consequent interference and loss due to theories which have no true basis.

Our knowledge of the diseases of animals is a necessary addition to the knowledge of the diseases of man possessed by medical men, if the public are to be protected from the danger of transmissible disease. Among pathologists this is fully recognised, but it is a fact not quite appreciated by the public or local authorities.

Having now I hope shown very carefully how necessary is the aid of veterinary science in general pathology, let me say a few words as to its practical application. If our usefulness were limited to the aid we can

give in the case of the diseases mentioned, I think I have said enough to demonstrate the need of a veterinary officer on the staff of all local authorities. But there are other claims I must advance in favour of the larger and wider use of veterinary knowledge.

Meat inspection is daily becoming more generally recognised as a necessity, not because butchers need more attention than other tradesmen, but because their business is more closely connected than others with public health; good and bad meat are not simple materials which can be distinguished by any untrained person. At present meat inspection is adopted in some places and not in others. It is fairly carried out in some large towns whilst in others it is muddled through anyhow. The official who is legally responsible for distinguishing good meat from bad is the inspector of nuisances. Experience and intelligence have in many cases made these officers competent inspectors, but in the majority of cases they are quite incompetent for the task, and consequently either the butcher or the public suffers. An incompetent inspector may pass bad meat and he may seize what is quite fit for human consumption. There is only one man who by his training and experience is capable of recognising the various conditions seen in carcases and of estimating their effect upon the meat, and that man is the veterinary surgeon. If I have shown that veterinarians are from their training and knowledge possessed of acquirements necessary to the really effective sanitary protection of human beings, it follows logically that they should be utilised in the public service. Local authorities desirous of having a complete staff of professional advisers cannot dispense with the aid of a veterinary officer.

Animal life in every district is numerically little short of human life, and the reaction of one upon the other for good or ill is a matter that the progress of modern pathology brings more and more into prominence as the years pass by, and as science becomes more exact and more practically useful.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS.

By ISAAC YOUNG.

Chief Sanitary Inspector, Battersea.

(Associate.)

President of the Conference.

TO have the honour of presiding at this important Conference is one, I feel, of which any Inspector may be proud.

You are aware that, until about five years since, the position I am privileged to occupy was filled by gentlemen engaged in professional walks of life other than that of an Inspector, and although estimable and talented as these gentlemen were, we are cheered by the fact that the Council of the Institute now recognises the position as one to be occupied by an Inspector, who, of all men, can alone know the desires and aspirations of his colleagues who assemble at these meetings. But to me, gentlemen, the honour is the greater by reason of the fact that I also represent here to-day (as its Chairman of Council) the Sanitary Inspectors' Association, and I do not hesitate to express the hope that before long there may be but one Association of Inspectors for the United Kingdom, and that its Chairman, for the time being, will be considered worthy by the Council of the Institute to preside at these gatherings. Of the question of one Association I shall briefly speak later.

Sanitary Inspectors, until more recent years, were not appointed to their office by reason of the ability or qualifications they possessed for the

position, but to-day there is assembled here a large and representative body of officers, who by training and experience have qualified themselves to efficiently discharge the duties devolving upon them in such a manner, let us hope, as will be to the lasting benefit of the community, and we recognise and appreciate the efforts of The Sanitary Institute, which has, by its teaching and influence, helped in no small degree to improve the status of the Inspector.

In the name of the Council of the Institute I heartily welcome you, and express the pleasure it gives me to meet so many of my *confrères* gathered from all parts of the country for the purpose of discussing together certain phases of our work, and elucidating some of the public health problems in connection therewith.

May the outcome of these deliberations not only prove beneficial to ourselves, but more particularly to the public, whose servants we are, and who have the right, therefore, to expect that in all questions as affecting the office of an Inspector we shall be both competent and reliable.

It is not my intention to occupy at any great length the time of the Conference by delivering to you an address upon any particular sanitary subject, lest my remarks should overlap in some measure the papers to be submitted by the various readers for discussion.

There are, however, some points in connection with our duties, as well as others concerning our position, that I wish to speak to you upon, and although they may not be new to you, I trust they may not be considered either out of place or unprofitable.

The first is the question of the present method of training persons for the office of Inspector. In this connection, I would ask whether we are fully satisfied—having regard to the great and growing importance of our duties—that the public is as efficiently served as it has the right to expect by the appointment of persons to the office who have had merely a technical training for the work.

There are probably some Inspectors who will not view this question in the same light as myself, and may doubtless ask: "Are not the persons seeking appointments, so far as their examination is concerned, as well qualified for the duties as those Inspectors at present in office?" To a great extent this may be perfectly true, but the time in my opinion has arrived when a compulsory term of practical training ought to be regarded as the primary qualification for the office.

The duties of the sanitary inspector are day by day becoming both more important and increasing in number. This is, no doubt, due to the fact that sanitary science, whether looked upon from its medical or

engineering standpoints, is continually enlarging its bounds and therefore its sphere for usefulness in promoting the great cause of public health, and we also must make progress with it by extending our own knowledge, thus fitting not only ourselves, but our successors in every respect for the work.

The essential qualifications in the old days for an inspector were zeal and common sense, and whilst these must not even now be wanting, they are not sufficient to meet the requirements of the present day. The duties devolving upon the inspector under the Public Health and other Acts demand that he shall be thoroughly conversant with every branch of sanitary work, and possess trained intelligence and skill in regard thereto if he is to be successful in assisting to remove those conditions which predispose the community to disease, whether arising from defective drainage, insanitary dwellings and workshops, polluted water supply, dampness, filth, decomposing animal and vegetable matters, whatever in fact produces atmospheric impurity, all of which have the effect of lowering the health and vigour of the human system, and thereby rendering it more susceptible to preventable diseases.

Besides these duties those connected with food supply, whether looked upon from the point of view of diseased, unsound, or adulterated, require that the inspector shall possess special knowledge and training for his work in this respect also.

It is because I realise the great and important character of our work that I have laid this subject before you in such detail. Many other reasons might be adduced in support of an obligatory term of practical experience as being necessary, in addition to an examination similar to that which at present obtains. You are aware that the provisions of the Public Health (London) Act, 1891, specifies one of two qualifications as essential in a person appointed as an inspector in the Metropolis. One of these may be said to be a theoretical, and the other a practical qualification. The purport of the section reads:—

> "That he shall be the holder of a certificate of such body as the Local Government Board shall approve; that he has by examination shown himself competent for the office, or shall have been a sanitary inspector or inspector of nuisances of a district in London or the provinces containing a population of not less than 20,000 inhabitants."

If these two qualifications were combined and extended also to the provinces, the necessities of the case would be met. The Sanitary Insti-

tute, with a view to meeting the difficulty, some time since suggested to Sanitary Authorities that they should allow persons seeking to become sanitary inspectors to attend with their own officers, in order that they might obtain a practical knowledge of the work. I may therefore conclude from this that the Institute fully recognises the necessity for practical training. After much thought, however, I can only see one way in which this can be effected, and thereby our future colleagues efficiently fitted for the work, and that is by the Local Government Board recognising the appointment of assistant inspectors, and sanctioning the payment of one-half of their salaries as in the case of inspectors. Such a step would, I am confident, bring into our ranks men better qualified to undertake the duties of the office, when called upon to accept the responsibility than is at present the case, and I am of opinion that at least two years' service as an assistant inspector should be regarded as the minimum qualifying period.

As a question closely related to the last, I feel I should be failing in my duty were I not to remind this Conference that the sanitary inspector is still unrepresented upon the Examination Board for Inspectors, and also that of The Sanitary Institute. Whilst no objection may be offered to the various persons representing the several bodies now constituting these examining authorities continuing to form a part thereof, I am confident this representative gathering of Inspectors will agree with me that a great injustice has not only been committed, but is continued by excluding the inspector therefrom.

In all other walks of life in which special knowledge or skill is required, the person must give proofs of his ability to the profession he is seeking to enter, and I see no reason why any exception to this rule should be made in connection with sanitary inspectors.

Next to the general public in point of importance for qualified officers to be appointed is that of the inspector himself, and I cannot refrain from expressing the hope that the voice of this Conference will be heard petitioning the Council of the Institute to appoint a sanitary inspector on its own examining body, and further to use its influence in securing to the inspector representation upon the Examination Board, now recognised by the Local Government Board as the qualifying body for inspectors for London. I do this with the greater confidence from the fact, that by far the larger number of sanitary inspectors at present holding office have been certified for their positions after examination by the Institute, and moreover, that a very large percentage of inspectors are either Members or Associates of that Institution.

There yet remains the settlement of that further question upon which we feel so keenly, namely, the insecurity of tenure in which the inspector holds office.

True, some progress has been made in this direction by the Local Government Board approving appointments for five years or indefinite periods, but this has not met the difficulty. The remedy is not in the appointment, but rather to prevent the ease with which the sanitary inspector may be discharged by the Authority appointing him. Like many other questions connected with public health it has already been too long delayed, and as a consequence both the community and efficient inspectors have suffered. In fact, it sometimes seems doubtful if the services of the sanitary inspector will be justly recognised until there shall be appointed by the Government a Commander-in-Chief of the great sanitary army, a Minister of Public Health, who shall not only be in touch with the units of the forces scattered throughout the length and breadth of the country, but who shall be the axis, as it were, upon which the wheel of sanitary improvement shall revolve.

The question of safeguarding the health of the community is a national one, and demands that if the laws relating thereto are to be effectively and uniformly administered, such a recognised head is essential. You will doubtless agree that the Public Health Acts require both amending and consolidating, but if these are to be of a decentralising character, as has been the tendency of the sanitary legislation of recent years, the office of the inspector must be made secure, and that he shall be more independent of those he serves, free to act in spite of opposition from vested interests, which still unfortunately dominate the councils of some sanitary authorities: further, that in any extended legislation the overlapping of duties such as at present obtains must cease to exist. The latter defect, I think, may be largely attributed to the piece-meal legislation which appears to be an inherent characteristic of our law makers.

Speaking as an inspector to inspectors, they should be freed from undue interference, held directly responsible to a central department of public health for the discharge of their duties, and these, in my opinion, should also include all sanitary duties now performed by the Home Office inspectors with regard to factories. It has been argued that it would never do to place the administration of the Factory Acts in the hands of the local sanitary authorities. My answer to this will I believe be equally yours, viz., provide sufficient sanitary inspectors, pay them a salary commensurate with their important duties, and so long as their work is faith-

fully and efficiently performed, uphold them in their office. This is the only remedy that can and should be applied.

I regret to say I have observed during the past few years a tendency on the part of some sanitary authorities not to require their sanitary inspectors to attend their meetings. This, to my mind, is a most unfortunate and retrograde step. Its tendency will be to take away the deep and zealous interest sanitary inspectors have always shown in their work; besides which, as a highly responsible public health officer, he should report direct to the authority by whom he is appointed.

There are several important questions connected with the Acts under which we work I had desired to speak to you upon, but as time will not permit I propose to very briefly refer to two only which at present are engaging the attention of our Metropolitan Borough Councils in particular, and it may, therefore, be considered opportune for me to bring them under your special notice.

The first relates to the unsatisfactory state of the law with regard to existing combined systems of drainage requiring repairs, etc., and which, owing to the fact that it cannot be shown by documentary evidence that such systems were sanctioned, the sanitary authority is made responsible for that which clearly should be the duty of owners of property. It would be presumptuous on my part to labour this question before such an enlightened assembly, but I may perhaps state that the question is more particularly a Metropolitan one, inasmuch as districts controlled by the 1875 Public Health Act may fix the cost of repairing such system upon the joint owners of the property by adopting the Amending Act of 1890. But even the latter Act is only partly effectual in making the owner liable, for the simple reason that if the block of houses drained by the combined system belong to one owner, the sanitary authority are liable for its repair as a sewer. It may not be surprising to this Conference to learn that a sum of not less than £30,000 is being annually expended by the Metropolitan Borough Councils in the repair of combined systems of drainage serving private property, and that this unjust burden upon the rates is continually increasing. My own Council between the years 1897 to December last has expended no less than £11,353 upon such works. In addition to this enormous outlay, it must be remembered that such drains still constitute sewers vested in the sanitary authorities.

But to us, as officers charged with the duty of abating nuisances, another side to that of expenditure presents itself. It is that where such drains—serving more particularly private dwelling-houses—are found defective, and may, therefore, in such condition prejudicially affect the

health of the occupants by remaining so for indefinite periods; that weeks and sometimes months elapse before the nuisance is abated whilst the question of whose the liability is to remedy the defects is being disposed of, that I feel this Conference would be perfectly justified in taking steps to assist in removing this anomaly, for such it undoubtedly is, when it is remembered that where the Authority can produce evidence that the system has been sanctioned the owner is liable, but where such evidence is not forthcoming, owing to the fraudulent action of the original or subsequent owner in surreptitiously making the drainage system a joint one, then the sanitary authority is liable.

With a view to remedying this state of affairs the London County Council in 1896 drafted a Bill, and during this and four successive sessions introduced it into Parliament, but without success. This is the more surprising when it is remembered that during this period—viz., in 1898—the West Ham Corporation Act was passed, section 42 of which relieves that Authority from all liability in such cases. An effort is again being made by the Councils of the Metropolitan Boroughs to remove this increasing burden upon the rates, and we might reasonably ask, for the benefit of the public health, that the Council of the Institute will use its influence in the proper direction to remove such a stumbling block to efficient sanitary administration.

The next point I would direct your attention to is with regard to certain provisions of the Sale of Food and Drugs Acts which are evaded by milk dealers, etc., and to suggest that, inasmuch as upon the members of this Conference largely devolve the duties of administering these Acts, the Board of Agriculture and Local Government Board should be appealed to, through the Council of the Institute, with a view to obtaining an amendment of the law.

You are aware that samples of milk, etc., may be taken at the place of delivery by an officer of the Authority of that district appointed under these Acts. The place of delivery, as between consignee and consignor, is generally a railway station, and this is not unfrequently situated outside the districts of the Authorities in which the milk will be sold by retail, and as these officers have no legal right to take samples except in the district for which they are appointed, it is not at present possible to efficiently administer the Acts. In the interest of the public, therefore, the law should be amended, and that speedily, to enable an officer to procure samples of articles which are consigned to his district at any place of delivery outside his district, and if such samples upon analysis are

found to be adulterated, to take all like proceedings as if the place of delivery were situated in the district for which he is appointed.

I now wish to say one word upon the want of unity amongst sanitary inspectors. If any apology is needed from me in introducing this subject to you, let me say it seldom occurs that we are brought together in such numbers. Further, that the time never was more pressing or more favourable than the present for the fulfilment of that great object I believe we all have individually at heart, whether we are members or not of one or other of the Associations of Inspectors. For years past the question of union has been the subject of discussion in the various organisations of inspectors, and it is difficult to comprehend why we should have remained so long separated when we remember that the objects we all have in view are the same, and that, moreover, these can only be obtained by a welding together of our forces. We see the effect in all other professions of what unity does, and what it has accomplished for these it can and will do for us. For years it has been the keynote of the wage-earning classes, and its effect can be daily seen when any common enemy threatens their interests. Let it not be thought that I advocate anything like trade union principles amongst us; I only refer to it in order to show the power and influence that unity would beget in our own ranks. We cannot longer delay this important question; our necessities and future existence as responsible health officers appear to me to depend upon our seeing eye to eye and standing shoulder to shoulder in a common cause, as otherwise what we have thus far obtained we stand to lose. I am hoping that the end may be speedily accomplished, and it rests with you and me to lay aside our petty differences, if such exist, in order that we may succeed. How much depends upon it in the interest of public health as well as ourselves it is not at present possible to comprehend. With this object in view the Sanitary Inspectors' Association has altered its Articles of Association in such a way we hope as will remove every obstacle that may have prevented the formation of one great and indivisible body, one which shall be influential in all parts of the country, consisting of strong and active centres to which shall be allocated the whole of the members, hon. members, and associates, with a central executive council composed of representatives from the various centres, and holding its meetings in various parts of the country. These are the principal features in the alterations.

The draft, having been approved by the members, is now in the hands of the Association's Solicitor, and will shortly come before the members again at the statutory meetings for adoption. I have felt justified in thus

speaking to you as the mouth-piece of the Association, and trust that if it is not possible to form one Association representing the whole of the United Kingdom, that it shall be one embracing England, Ireland, and Wales, and that then an acceptable scheme of federation will be evolved by which our Scotch brethren will be federated with us. I therefore ask that with this great object in view we shall individually and collectively firmly resolve to achieve it, and thus help on our mutual interests and the progress of sanitation.

CONFERENCE OF LADIES ON HYGIENE.

ADDRESS.

By Mrs. J. A. GODWIN,

PRESIDENT OF THE CONFERENCE.

WHEN the Local Committee asked me to be your President, I accepted with much fear but more pleasure, and asked myself Why should this honour fall to me? However, as my conspicuous lack of qualifications to fill this chair is too large a subject for this morning, I will at once proceed to offer you a most hearty welcome to our city on behalf of those who, like myself, are deeply interested in all work for the amelioration of suffering and the advancement of science, which is surely the aim and object of this Sanitary Congress. We hope your twenty-first meeting may be at least as pleasant as all its predecessors, for even if our skies are grey and our streets dull, we claim to have lovely excursions close at hand, and in our very midst the throbbing pulses of the mills where the great wool trade is carried on. The mills should well repay you for a visit, where many hygienic inventions have been applied, such as ventilating shafts, fans, smoke consumers (more or less successful), cleansing and disinfecting of fleeces, etc.

About three years ago we woke up to the fact that we needed a lady sanitary inspector, and had the good fortune to secure the services of Miss Stephens. She found a deplorable state of affairs, but has already done much by her visits, advice, and sympathy with the people, and her most lucid and able reports to the City Council, one result of which is that an assistant lady inspector has recently been appointed. Time forbids more, or a sketch of her work alone would form interesting and improving matter for hours.

This is the age of the novel and the play; could we not through these mediums reach the careless heart of the general public to the great work of sanitation? Even as Charles Dickens made us weep useful tears over Oliver Twist, as Kingsley did for tiny chimney sweeps and Jeffrey for the agricultural labourer in his picturesque and crowded cottage, and later still, Halliwell Sutcliffe's retrospective picture of the woes of little mill lasses, now long since dead.

What would make more sombre reading, or a greater tragedy than an account of the havoc wrought amongst those who work in dangerous trades, some of which bring us our most everyday necessities? Do we think of the potter's danger when we drink our morning tea from porcelain or from mug? Or at what price the lucifer is made? Can we hear the laboured breath of the choked up lungs of the mason, and those who work to make our furs rich and smooth? We love our homes to be bright with paint and paper and blazing fires, without a thought of lead and arsenic, of choke damp and gas. When our dainty woollen fabrics please our fancy and our touch, can we realise how many hearts have stopped their beating when the whisper goes of anthrax to the bread winner? Who heeds the plumber's danger when we send for him to find the cause of the smell we fear may prove so deadly to those we love? From any of these most simple pictures such tragedies could be woven that we should cry aloud for comfort. But the brighter side is surely there when our trades may be less harmful and our insanitary areas swept away—never to return—for if each one in his or her small way would honestly strive to understand the objects of work, such as this Congress represents, they would feel compelled to grant their aid of time, of sympathy and money, to all those waging war against these dangers. Let us adapt an old saying "Where war has slain its thousands, insanitary conditions have slain their tens of thousands."

I could wax garrulous on the difference between the days of my youth and now. How chimerical would the need of an institute like the Sanitary one have appeared to our grandmothers who nursed fevers and colds in rooms from which all light and fresh air were excluded, who drank water from wells and milk from the farms, who vaccinated us from each other, let in Sarah Gamp with her box of old clothes, bought flowers from the consumptive girl and fish and vegetables from the hawker, allowed spittoons as one of the necessaries of life, scouted the idea of danger in a sausage, saw no harm in the plumber who ran short of material and left a little gap, and would have deemed anyone mad who hinted at the connection between malaria and mosquitos! And yet if we

look through the list of dangers attacked by sanitarians, we find we have not mentioned a tithe of them.

Interest has awakened in all these matters, and the voice of science calls loudly that we should take heed to the evils of crowding, bad housing, poisoned water supplies, dangerous trades, insanitary conditions under which some of our food and clothing are prepared, and to urge us to use all existing means for purifying this state of things, and give help and sympathy to those struggling to increase those means.

Our grandmothers erred through ignorance, let us not do so wilfully, for as woman's sphere of usefulness is now so much enlarged, and her education so much more liberal, so has her responsibility increased.

Women are now honoured and peculiarly suitable members of Boards of Guardians, Schools, Hospitals, Prison and Housing Committees, from which councils they must resist all efforts to displace them.

We have before us a list of most interesting papers, on which I hope there may be a full and free discussion. I must say no more, except to crave your pardon for any inefficiency with which I may conduct this meeting. The work in which you are all interested and many actively engaged, is an unselfish one, inasmuch as it must affect posterity more than our own day and generation, but let us struggle on to the end, fearing nothing, but hoping much. Ages since One said "Let there be Light, and there was Light." In another sense let us repeat "Let there be Light," and so endeavour, each in our tiny circle, to aid the work before us—that a purer atmosphere, physically, and therefore morally, may obtain—and those who succeed us may add "And there was Light."

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

ADDRESS

By JAMES KERR, M.A., M.D., D.P.H.,

PRESIDENT OF THE CONFERENCE.

(MEMBER.)

REMARKS ON THE OUTLOOK AS REGARDS SCHOOL HYGIENE.

THE Sanitary Institute concerns itself with all that affects the health of people, and, therefore, rightly has this particular section dealing with School Hygiene.

It is strange that this department of Public Health work should have been allowed to lie comparatively uncultivated for so long. There are now, however, indications of a coming "boom" in this direction which may mean a popular interest from which some good at least is to be hoped. The full realisation of the fact that the individual is made or marred for life by the time school days are passed has not yet been attained; that this is the most plastic time, and that conditions of school life are actually harmful by depriving the organism of much of the natural stimulus to growth.

Educationalists are just beginning to suspect that much time may be wasted in premature work, is wasted in a treadmill of precocious work, which at a later age would be learned effectively, rapidly, and with little effort. Over pressure and resulting bad school habits which affect almost every detail of after school life are the result of the prevalent methods of infant teaching. The modern methods will eliminate this unsuitable work with its fatigue and over-pressure. It is to be hoped that within ten years a needle, for instance, will never be seen in an infant school. But before school age is reached a large number of individuals are damaged beyond hope of complete repair, and many damaged by means which might easily be avoided.

Whilst the death rates from parasitic infections are steadily diminishing and therefore, it may be concluded, shew the efficacy of measures taken with a view of preventing public dissemination of disease, the home infections—if such a phrase may be used—remain as bad as ever; as many children die of infantile diarrhœa as formerly, and whooping cough and measles still claim an undiminished tax of child life. This tax on infant life is very great in the West Ward of this city, half a mile from where we now are, about one child out of every five is dead before the first birthday comes.

Apart from these fatalities in which the statistical tables shew little or no improvement, there are the multitudinous conditions that spring from ill-feeding, and leave results not only in ricketty deformities, but in the children whose brains are damaged and intellects enfeebled by early convulsions. Next to drink, the cause of the most of all misery, ignorance in the home, is the chief factor of that death and disease in very young children, which is beyond the grasp of the Medical Officer of Health, and out of reach of his Sanitary Inspectors.

Education permeating these homes is the only way to effect improvement. The mothers must be taught how to treat their children, the importance of cleanliness, the necessity for fresh air, and the importance of getting good food in sufficiency and cheaply. Even at the ninth hour, with much expenditure of time and trouble, a tactful woman with the right knowledge might go into the homes and teach each individual mother the things which it is to the general interest that they should know. But much more easily can the future be prepared for. The mothers of ten years hence are in the schools now, and they can be taught there. Who is to teach them? Many of the teachers have ideas on such subjects quite as hazy as the mothers whom we have been speaking of, it is therefore very evident that in the widest sense it is necessary for the next generation that the elementary school teachers should have their plethora of unnecessary facts reduced to make room for a little about the hygiene and physiology of good living.

One of the events of the past year in the educational world has been the report of the Royal Commission on Physical Training (Scotland). This report has an appendix of some careful examinations done in Edinburgh and Aberdeen schools; unfortunately this work attempted too much, it was too detailed and insufficient in amount; good as far as it goes and pointing to the need of more of such work, it errs in being used as the basis of generalizations which are scarcely justifiable. It is quite unjust to compare groups of children unless the ages are taken at least year by

year and sufficient numbers are used. In regard to some of the generalizations the want of attention to these fundamental rules lead to astonishing results. For instance, the amount of phthisis in Edinburgh school children is estimated from figures which equally justify the deduction that consumption is most prevalent in the children who live in the roomiest houses and are tallest, heaviest and best nourished for their age—"a fact" as the examiner writes, "not to be expected and not easy to explain."

Fortunately the report of the Commissioners in no way hangs on these statistical fragments. They took evidence and had such matters brought under notice as the need of almost all schools for efficient ventilation, insufficient heating, the prevalence of physical and mental defects, the existence of defective methods of education involving time wasting work, needless repetitions, of over-pressure and fatigue from premature work, the necessity for proper feeding and so on. And they came to the conclusion that it was desirable that all schools should be under regular medical inspection. In other words, that school doctors were wanted, and that the central authorities needed the assistance of medical advisers.

A Department, having the oversight of one-sixth of the population, at the time of life when habits are being formed and the seeds of future good or ill health are being sown, has muddled through half a century and the expenditure of many millions of money without any medical advice. Now comes an educational landmark, this statement of the Commission that school doctors are wanted; the first official recognition of the necessity of medical knowledge and supervision in education.

Bradford had the credit, ten years ago, of being first in this country to appoint a medical man to visit the schools regularly and examine into whatever affected the well-being of the children in these schools. A few other places are following the example in a half-hearted way, but during that period in America, in Germany, and in many other of the smaller European States, hundreds of medical men have been appointed for similar functions.

Any medical man is not sufficient for such an appointment. The school doctor is primarily a scientifically trained man who must also have had a medical training. He gains his experience of educational things gradually. The Edinburgh examiners who found 294 out of 298 girls with some condition of disease, however remedial, of ears or throat, had not gained that experience. It scarcely seems possible that one-third of the Scotch children need to wear glasses, their vision being reported such that they "were requiring correction for school purposes at the time," and I am quite certain that the results of testing the hearing of children by the

ticking of a watch has more to do with their intellectual interpretation of what they hear than with their aural conditions. These are details in which the need of experience of children's ways is shown forth.

School authorities who wish to do the best they can for their children will try to obtain a medical man who has had such general scientific training as is required for the possession of a diploma in public health. At the same time, the school doctor has work which lies far apart from that of the ordinary medical officer of health. This last, indeed, only touches the work of the educationalist in the very restricted field of sanitation of buildings and prevention of infectious diseases. The appointment of a general practitioner to such a position at a trifling salary is a very penny-wise policy. Successful general practice is fatal to success as a school doctor. Lastly, the labourer is worthy of his hire. The very low remuneration which some School Boards have offered for such appointment shows their want of appreciation of the qualities required for such a post, which, as a rule, will require quite half the medical man's working hours.

Much of the work which he does has to be in a sense prepared for by the teachers, it should also be done with economy of time and without much interruption of schoolwork, and a good deal depends on the doctor's skill and ability in eliciting the co-operation of the teachers, some of whom are indeed enthusiastic, whilst occasionally the very reverse is the case. As knowledge increases, more will be expected and demanded from the school doctor, and much work might possibly be done under his superintendence by trained assistants corresponding to Sanitary Inspectors.

The modern school is really becoming a complex machine into which are put 500 to 1,000 children in the most impressionable and plastic condition of body and mind. The teacher controls every branch of his work, he has to look after heating, ventilation, moistening of the air, removal of dust and cleanliness of schoolrooms, the general health of the children, their anæmia or debility, the physical exercise required, the exclusion of those ill or dangerous to others, the vision, hearing, mental peculiarities of special children, their cleanliness, their work and progress, and so into numberless details; and the man who looks after, and is responsible for the working of this complicated machinery, has not been in any way prepared for a very great part of his work before coming to school, but has to pick it up by rule of thumb from others almost as ignorant as himself.

The first result of any general appointment of school doctors will be this demand for the general training of future teachers in the work that

they are called to do. The only way in which this can come about is by insisting on a training in hygiene (including school hygiene) both practical and theoretical as a requirement in every teacher's qualification. Hygiene should be a requirement in every school course, and gradually there will develop the living interest in the details of hygiene, which will make school life a practical training in the prime necessities of cleanliness and healthiness. It is to be hoped that the necessity of these things will be impressed on educational authorities, both local and central.

To revert to the Royal Commissioners' Report. It alludes in unmistakeable terms to all these matters.

In regard to subjects for teachers' training, specifying Physiology, Hygiene and the Laws of Health, section 26 says: "We would here point out how important we consider it to be that those who are about to become members of the scholastic profession, and particularly those who are to teach physical exercises, should themselves be instructed in such subjects."

And again in section 40, speaking of every higher class day school: "instruction should be given in hygiene and physiology. It is most important that the pupils should not only have mastered the practical part of the training, but that they should understand something of the theory upon which it is based."

Lastly, section 152, speaking even of the smallest child, advocates the development of the sanitary conscience. "We feel convinced that some of the prevailing defects in health and physique might be very materially mitigated, if not removed, by a little timely attention and by the careful inculcation of some simple rules of health and of the proper means of conserving physical strength and of developing physical faculties which are now too often completely neglected or ignored. These must be taught early if they are to become matters of habitual practice."

This report should be the beginning of great things in school hygiene and its results on the home and national life. A new era is dawning in educational progress. Powerful authorities will shortly cover the whole field and they will not stand still, but progress. The outlook in our field of work is hopeful and bright.

LECTURE TO THE CONGRESS.

By JOHN SLATER, B.A., F.R.I.B.A.

(MEMBER.)

ARCHITECTURE IN RELATION TO HYGIENE.

WHEN the Council of The Sanitary Institute did me the honour of inviting me to give the lecture to the Congress this year, I assumed that their reason for doing so was their desire that the vast subject of Sanitation should be treated not so much in any of its particular details as from a more general standpoint. I shall, therefore, endeavour this evening to bring before you some of the points of contact between hygiene and architecture, taking each of them in their broadest aspects. I remember nearly four and twenty years ago, in a paper read before the Royal Institute of British Architects, mention was made of an architect of some eminence at that time who had built a house for a client, and some four months after its completion this architect was asked to come down and inspect the house because some of the drain pipes were stopped and there were difficulties with the plumbing arrangements. The architect was most indignant, and simply told the client to send for his plumber. I doubt if now-a-days any architect, however much he might be imbued with an exalted idea of the high artistic nature of his profession, would take up such an attitude, as we have learnt to appreciate the fact that however beautiful you may make a building, its main purpose is to be lived in or worked in, and that unless it is constructed with due regard to health, it will be but a whited sepulchre. Hence the necessity for close supervision of all details of construction, however small or apparently unimportant, and to some of these details I shall call your attention this

evening. But there is a wider aspect of the question which has not often been dealt with, viz.: How far the purely artistic side of architecture is concerned with hygiene? And this consideration may possibly carry us rather far afield, and I must ask your patience if this paper should appear at times too discursive.

It is as well to clear the ground at the outset by accurately defining the issues of the subject. I am not going to discuss the vexed question of architecture being an art, a science, or a profession, and I shall simply take it—as it was once defined—as building at its best, and hygiene embraces all matters concerned with the health and well-being, physical and moral, of the individual and the community. So you see I do well to warn you that you may find me somewhat discursive.

It would be exceedingly interesting, had we sufficient data on which to base any reliable conclusions, to take a rapid historic survey of the position which hygiene and sanitation generally held among the ancients, but unfortunately we know very little of the subject. It is, however, impossible to believe that the ancient building nations—the Egyptians, the Assyrians, the Persians, the Cretans, the Greeks, and the Romans—all of whom, in addition to erecting buildings which have been and still are the admiration of all who see their remains, held in the highest esteem physical health and physical development, can have been altogether neglectful of sanitation, though they were doubtless ignorant of the scientific principles on which it is based, and, in fact, the more recent explorations of the relics of ancient civilizations have brought to light many striking instances of careful provision for sanitary requirements. At Khorsabad in Assyria, at Persepolis in Persia, and quite recently in Crete, have been found most accurately made conduits or sewers to take away from the buildings the refuse water, etc. And with regard to fresh air, it must be borne in mind that in nearly all these countries the climatic conditions were such that a great part of the life of the people was passed in the open air. In Rome these conditions were somewhat different, but in one respect at least the Romans were in advance of us, as their solid floors, with hypocaust heating arrangements, tended in a remarkable degree to cleanliness and healthfulness. In the middle ages no doubt the sanitary arrangements were of the most primitive kind, as may be seen in an amusing manner in some old walled city like Aigues Mortes or in many an old castle, but at any rate, primitive as they were, the winds of heaven exercised their cleansing influence freely, and I firmly believe it would be difficult to find in any mediæval city worse conditions than prevailed even in my own time in many of the London theatres, as detailed

in a paper read before the Institute some few years ago, or in bakehouses, factories, and workshops all over the country. The fact is, people sometimes seem to forget how very modern sanitary science is, and how enormously difficult it is for anyone—and I include members of my own profession here—to get out of the ruts in which they have been quietly jogging along year after year. In the East the perpetual dread of cholera and similar diseases has practically no effect in causing the inhabitants to adopt cleanlier habits, or to avoid taking their drinking water from putrid rivers and contaminated wells, while in our own country the insanitary survivals of old-fashioned methods of construction afford a splendid object lesson to us all. I propose to call your attention to some of these, and to show how easy it would be to substitute a very much better state of things.

It is more particularly with the smaller houses for the working and middle classes that these survivals are to be associated. In a nobleman's mansion, where there is a large staff of servants, cleanliness is generally attended to, though even here the servants' quarters often leave much to be desired; but in smaller houses the one aim should be to construct them in such a way as to leave to the inmates the very minimum of attention required to keep the places clean, because you may be sure, in many cases, that minimum will never be exceeded and often not reached. The amount of money that is expended in England and in all the more civilised countries on the cure of disease, and on buildings devoted to that purpose, is simply enormous. The greatest care possible is taken to ensure cleanliness and to minimise opportunities for the propagation of microbes, and there can be no doubt, that since the principles of sanitation have been known and carried out, the percentage of cures of all kinds of diseases has enormously increased. And yet, how much better is prevention than cure! Every year, in the outskirts of all our large towns, acres and acres of new sites are covered with houses for the lower classes, which, even when they are new, are scarcely sanitary, notwithstanding all that local bye-laws can do, and undoubtedly, in a few months, become foci, if not of disease, yet of poor health, and the inmates of such houses become increasingly unfitted to struggle against disease. In this connection I cannot refrain from quoting some sentences from an Article in the '19th Century' for May. The author says: "the economical conditions of industrial life now-a-days are such as naturally to affect injuriously the physical development of those engaged in it. The main cause affecting the physique of the nation . . . consists in the growing absorption of the population into big towns. This means that hundreds and thousands

of men, women and children now live under very unhealthy conditions. While their forefathers lived, for the most part, in the country, where light, air, exercise and contact with the woods and fields of English pastoral life, had a healthy and invigorating effect on body and mind alike, the vast majority of the people now live in large towns, and to them light, air, space, all that goes to make a happy and healthy human being, are greatly lacking." These are weighty words and should be taken to heart by all sanitarians.

I am not unmindful of the fact that a great advance has been made in artizans' dwellings, which now have the greatest possible attention given to their construction, but as soon as you get just above the artizan class, the poor struggling clerk or the shopman and the small tradesman, you will find that the dwellings themselves are not one whit better than they were 50 years ago, whilst the surroundings of these dwellings are infinitely more confined than used to be the case. The methods of construction which are good and necessary in a hospital, are equally good, and to my mind, almost as necessary in an ordinary dwelling house, and they could be provided in the latter at a very small extra outlay beyond what is generally spent. The fact is, that of late years, the working man has monopolised the attention of the benevolent and the charitable. I should like to see some capitalist take up the cause of the lower middle classes and start a company for the erection of middle-class dwellings at reasonable rents, and as our municipalities are going in for commercial speculation, they might find this not one of the least profitable. I know that the Artizans', Labourers' and General Dwellings Company, which has gone on these lines, has always managed to pay a dividend. Local bye-laws have done much to rectify flagrant abuses, but you cannot frame bye-laws to meet all small details, and the worst of it is that what bye-laws specify as a minimum in the way of requirements, is always taken by the speculative builder as the maximum.

The fact is, we want fewer hard and fast lines laid down, and literal specification of requirements in our Building Acts and Bye-laws, but more discretion left in the hands of those who have to carry out these legislative enactments. This opens up what is, to my mind, one of the most important questions relative to the health of the people; I mean the standing and qualifications of inspectors and other officials, who have practically the whole matter in their hands, from the highest to the lowest, from the District Surveyors who have to carry out the provisions of the Building Act of a great city like London, to the small building inspector of a Rural District Council. It seems almost impossible to get local

Councils to appreciate this. What do we see all over the country? A local builder, who has failed in business, gets some kind friends to propose him as building inspector, or perhaps even surveyor, to the local Council. Be he as honest and painstaking as possible, how can such a man enforce to the full, regulations which he has been for years trying to evade as far as he could, and the necessity for which he is probably very doubtful of? He will inevitably incline to leniency, which will soon become laxity, and many of the minimum provisions of the Acts will not be enforced. It cannot too often be insisted upon, that the national health is the most important factor in national life, even when looked at from the lowest pounds, shillings, and pence point of view—and that it would pay in the long run many times over to raise the salaries of the various building inspectors, etc., so that you would ensure the occupants of the posts being men of position, and above all underhand influences. I don't know whether it would be possible for the Local Government Board—which I know is already an overworked department—to add to its burden of work, but in my opinion the appointment of every health officer in the country and the amount of his salary should be subject to the approval of the Local Government Board, and then you might make the Acts themselves which have to be carried out much more elastic. The unhealthy conditions in which so many workers habitually live affect the death-rate appreciably, but they do a great deal more than that: they lessen very materially the productive power of the community, and no one can estimate the cost to the country of the persistence of such conditions.

Now let us look somewhat more in detail at the development of a new suburban estate where the roads and sewers have been made, and where the houses would probably let for about £20 to £30 per annum. When finished these houses would appear to an ordinary passer-by to be of very attractive elevation. There would probably be on the ground floor, or perhaps even carried up to the first floor, an octagonal bay window with stone jambs and head; small stone columns to a slightly recessed porch with quite elaborate carved capitals; slated roof with tiled ridge; and inside, stoves with tiled sides and elaborate cast-iron or enamelled-slate chimney pieces—and people would say: How extraordinarily cheap!

But let us look a little more closely, and follow up step by step the action of the builder who has erected these attractive bijou residences, having taken a number of plots on lease, and who desires to make the speculation a good thing. He will take care first of all to get his plans—drainage and all—passed by the local district council, then he sets to work merrily. We will suppose that the site has been pasture used for grazing

purposes, and that the subsoil has not been touched. The first thing the builder will do is to make some trial holes and ascertain if there is any gravel or sand. If this exists, he will be sure to provide a cellar; and, in addition, unless he is stopped by the freeholder, he will make extensive excavations in the space to be allocated to backyards and gardens and get out all the gravel he can. Now, this ought to be absolutely prohibited, because the ground made up over the hole excavated (even if this is not filled in with offensive stuff) will certainly not be so healthy as if the soil remained undisturbed; but so long as the house itself is not built on this made-up earth the local authorities cannot interfere. But suppose the soil is clay—waterlogged or not, as the case may be. He will then dispense with a basement, as costing too much, and he will take off the turf and a few inches of soil under it, and he will proceed to comply with the local Act by laying six inches of so-called concrete over the site to be built on. If he is not very carefully looked after, he will let this concrete act for the foundation of his walls, none of which will be more than nine inches thick, but he may take the footings of his walls a little lower down. Now, what is the concrete composed of? There will be a certain amount of lime, a certain amount of ballast, and a very uncertain amount of what looks suspiciously like garden mould mixed with it. If the freeholder's architect sends down to see how the work is progressing, and asks questions about the ingredients, he will probably be told that the dark stuff is not garden mould—far from it!—but a most excellent substitute for sand, consisting of road-scrapings. Now, I am not prepared to say that, in districts where macadamized roads are laid with granite, *thoroughly washed* road-scrapings may not form by no means a bad ingredient for concrete or mortar, but the thorough washing is an essential, as otherwise horse-droppings and all sorts of filthy materials will be mixed in. But I have never seen this stuff carefully washed in such a case as I am describing; and, in my opinion, for all intents and purposes as far as the main object is attained of excluding ground-air from the house when finished, such a layer of concrete is practically useless. The finished level of the ground floor will probably be not more than two steps, or twelve inches above the ground level; the underside of the joists will be just the bare minimum above the concrete layer; the air bricks to ventilate the space under the ground floor will be placed so low down in the face of the external wall that they will be likely soon to get stopped up and be useless for their purpose, and dry rot will probably ensue; and the floor boards of the house will not be grooved and tongued, so that the joints will soon gape. The importance of excluding ground air cannot be too strongly insisted on.

You may have your drains perfect, but if the warmer interior of a house is continually sucking up the air from the soil, which is liable to contamination from leaking sewers, gas pipes, and all sorts of organic impurities, the effect on the health of the inmates cannot but be deadly. All this would be avoided if a thin layer of asphalt were laid on the concrete, and the whole of the ground floor were laid—as to the rooms, with solid blocks of wood, and as to the passages with cement or cheap tiles; and the extra cost of finishing the ground floor in this hygienic manner would not, in my opinion, be 1 per cent. on the cost of the house.

The walls of the house are rapidly run up, and it is desirable not to enquire too closely into the composition of the mortar, but what about the workmanship? The joints are not well flushed up, the consequence being that the damp caused by rain gets completely through the wall and damages the plaster, and is an inevitable source of catarrh, rheumatism, etc., and where the walls pass through the roof, a poor cement fillet will soon begin to shrink away from the bricks and let water in which will do more damage. Then the joists of the first floor are almost invariably carried on a weak stud partition, the sill of which, on the ground floor, rests on a half brick wall, this partition is not trussed and in many cases it is a perfect marvel how it manages to carry the joists. But these stud partitions have greater drawbacks than this: the space between the plaster on each side forms a run for mice and other vermin, and a receptacle for stagnant air which can never be purified, and retains the germs of all kinds of diseases which may have attacked the inmates. Furthermore, the plaster is never taken down to the floor level, but is stopped above the grounds for the skirting and consequently the only separation between the rooms for nine or twelve inches above the floor consists of a couple of one inch boards, and I have myself seen liquids spilt in one room run under the skirting into another, where, owing to shrinkage, the floor boards are no longer tight up against the skirting. Now, how by any possibility can a building constructed in this manner be healthy? For some few months after its erection perhaps no particular harm is done, but as soon as some infectious disease has been nursed in it, contamination commences, and in a few years, my firm belief is, that such a house becomes what in a hospital ward would be termed permanently septic, and it is almost impossible to get it sweet. Everyone must have noticed in visiting many a moderate sized house the stuffiness which is apparent in the rooms, this means that for some time past the air has been in an impure condition. Now, how easily might this state of things be rectified. A half-brick wall in cement would cost no more than the stud partition and would be a far more

sanitary piece of construction, as affording fewer stagnant corners for air, and at any rate this half-brick wall would form a far more solid separation between the rooms; and on the upper floors, when a thin light partition is required some of the new inventions of solid partitions, fire proof and vermin proof, would avoid the necessity of stud partitions. The space between the ceiling and the floor is another harbouring space for dust, dirt, and germs of all sorts, but I fear it would be too much to expect that small houses should be built with solid iron and concrete floors with the boards laid direct on and nailed to the concrete. In France even in small houses the upper floors are laid with concrete and tiles and there can be no difference of opinion that such floors are far more sanitary than ours.

What is no doubt badly wanted is a cheap form of solid floor. A new solid concrete floor, which has the merit of cheapness, has recently been patented; it is known as terrast, and can be used with ordinary wooden joists. This floor consists of some metal lathing laid over the joists and sagging down slightly between them; over this is laid a layer of thick brown paper, and above this about one a half inches of coke breeze concrete, to which of course the ordinary floor boards may be nailed. I know nothing about this floor, but at any rate it is an attempt to diminish the cost of a solid floor in the upper storeys. But would it be very repugnant to our notions if the plaster ceiling were omitted and the joists of the upper floor shown? You find this form still existing in Yorkshire and other parts of the country; or if you do not like to show the joists, put two large beams across the room and cover first with two and a half inch planks, and then a cover floor of ordinary boards. I have seen this done quite recently, and a very good effect it has. The great objection is that sound passes through such a floor very easily, but the omission of the ceiling would pay for some good non-conductor of sound being laid between two layers of floor boards. Moreover, in the case of small dwellings such as I am thinking of, which would be generally occupied by one family, the passing of sound between two floors would not be so objectionable as in tenement houses. Of course something to serve as a skirting is needed to stop the plaster next the floor and to prevent it from being damaged, but a cement skirting could easily be used on brick walls, or a solid fillet of wood if preferred. Now let us glance for a moment at the plumbing arrangements: If a bath or a w.c. be placed on the first floor it is almost certain that the supply cistern will be placed in the roof where it is very difficult of access. Now in any large city, the inside of the roof of a small speculative-built house covered solely with slates and battens is

one of the dirtiest places that can be imagined, and yet here the cistern is to be found which supplies water for all drinking and ablutionary purposes to the whole household. In the first place, why is a store cistern needed at all? The old intermittent service is happily well nigh obsolete, and with a constant service from the mains I see no reason why every fitting should not be supplied direct. Waste goes on equally with leaky taps, whether they draw their water direct or from a cistern, and, in my opinion, a leaky fitting would be more easily found out and remedied if directly attached to the main than otherwise; and moreover, if the supply is direct from the main, much of the cause of leaky taps could be avoided by means of a good governor regulating the pressure and placed on the pipe leading from the Company's main to the house. The pressure in the mains is necessary because the water has to be forced up to a certain height, and it is this great pressure which so soon spoils the taps. When a tap is turned no one wants a rush of water—just as if it was coming from a syphon. I have often wondered why some one has not invented—perhaps they have, though I have not come across it—a regulating governor similar in action to the regulating valves which are used for gas or the transformers for electrical energy. But *if* cisterns are to be used, then it is imperative that they should be placed in an open and airy situation so that they can always be inspected and cleaned out at intervals.

It has been urged that there shall be no roof properly so called at all, but that the building should terminate with a flat, and certainly, in town, where a parapet generally hides all appearance of a roof, and gives a monotonous straight skyline, there can be no possible reason why a flat should not be formed, and if this were cemented and covered with asphalte no more sanitary covering could be provided; but in suburban houses of a small type, I think the flat roof would be horribly monotonous, and that we must adopt roofs of a fair pitch, but the more space in the roof that is given to the rooms the better. I might mention several other forms of unsanitary construction, but I hope I have said enough to show what great improvements are possible. Drainage *per se* I have not touched upon, because the subject has been treated *usque ad nauseam*, and so much attention is given to drains that the greatest abuses connected with drainage have ceased to exist; but, in my opinion, it is a mistake to think that having the drains all right makes the house sanitary, and I fear this is the position too often taken up not only by the builder but by the sanitary inspector, and I should like to see everywhere a much wider view prevail of what is required for sanitary house-building. Hospitals and infirmaries which are now built at a cost, as we have recently heard, of

£500 a bed can take care of themselves because every detail of their construction is thoroughly well thought out, and the same applies to the large blocks of artizans' dwellings which nearly all our municipalities are now erecting, though I may have something to say about these from another point of view; but how can we secure improvement in the kind of dwellings of which I have been speaking, the inmates of which form the great mass of the workers of the nation? It is no new gospel I am preaching. In the past dozen years or more much that I have said to-night has been urged, far better than in any words of mine, at Hygiene Congresses and Sanitary Institute Meetings all over Europe, and yet so little has been done; and why? Expense is generally considered the great obstacle, but I cannot help feeling that there is a greater one which is this: the people who build the houses are so rarely those who dwell in them, and there is so little fixity of tenure. I am no socialist, but I cannot shut my eyes to the fact that the improvement of the dwellings of the people is a question which is intimately bound up with that of the ownership of the land on which they are erected, and until we can get rid of the middleman in the shape of the speculative builder, who only cares to put up his buildings at the lowest possible cost, we shall never improve the separate small dwellings of the people. How this speculative builder can be abolished is a question of political economy which scarcely comes within the scope of this paper, but when we see what is being propounded in Ireland as a cure for all the ills from which the peasantry of that country are suffering, I think we get a hint of a possible solution.

I see no reason why the lower middle classes of this country should not be trusted to fulfil their obligations as well as those in the sister Isle, and although it may not yet have come within the sphere of practical politics, I should not be surprised if, in the next generation, the Government were to take up the question of loans to small householders for the purpose of helping them to buy their own freehold sites and build their own houses, and if this were done we should soon see a vast improvement in the construction of the people's homes. My own belief is that such loans would be speedily and easily repaid. I know, as a fact, that small private houses, letting for say £25 per annum, are built and sold by the builder for £275. An extra expenditure of 10 per cent. would convert an insanitary house into a healthy one, and an advance of one half the cost of the building and site to the intending householder could be repaid easily, principal and interest, in say 20 years. The State would, in fact, put itself in the position of a large Building Society. But this is wandering from the subject of my paper.

I have now dealt with various points connected with the construction of a house, and we have seen how some methods of building tend to promote the health of the inmates, and others to prejudice their well-being. These matters are concerned with the practical scientific side of architecture, and I would now ask you to consider a somewhat more difficult question, which is: how far is the health of a people affected by the artistic or asthetic side of architecture; by matters which are not constructional, but are connected with site, arrangement of plan, surroundings, style, and design? Here again I would quote the old adage, "Prevention is better than cure." As I pointed out in the early part of my paper that methods of construction which are deemed essential in buildings devoted to the cure of disease must be equally beneficial for all dwellings, so you will find it to be with the matters which we are now considering. I need not dilate on the question of site, for every one knows that a wet, damp site, or one subject to inundations, can never be healthy. It is the pressure of population which brings about the utilization of low-lying, bad sites for human habitations, and I feel confident that there ought to be a power of prohibition against the erection of any houses, however small, for permanent occupation on sites which are manifestly unfit for the purpose, or if houses are built on such sites they should be raised on arches in order to make the principal or ground floor quite dry. Then again, as to surroundings, how is it possible for people to keep their health if they have never anything but dull dreary miles of streets to look at every time they come out of their house. I cannot imagine anything more depressing than the surroundings of some of the poorer quarters in many of the great towns of the North of England or in London, and bear in mind that mental depression inevitably re-acts on the physical health in a way that is too often lost sight of.

I read very lately that in the opinion of an eminent oculist, a great deal of the defective eyesight which is annually becoming more prevalent in towns, is due to the fact that these urban dwellers look so seldom on the pleasant restful green of the woods and fields, and so constantly on dull bricks and mortar, and if this opinion is well founded, it should undoubtedly make us give more consideration to the prominent tints which we use for both the insides and outsides of our dwellings. The condition of the brain is seriously affected by the state of the nerves of the eye, and the undoubted increase in diseases of the brain of late years may possibly depend, not only on the hurry and bustle of the daily life of the average business man, but also upon the dull, gloomy, repulsive nature

of his outlook for so many hours of the day. Just as light causes us to feel cheerful and warmth makes us feel comfortable, so I believe it will be found that colour in soft graduated tones has an immense effect on our well being. Staring, garish, inharmonious tints must have a somewhat similar effect through the eye on the brain, as loud cacophonous sounds have through the ear, and strange as it may sound, I firmly believe that it is almost as essential for the construction of healthy homes that the tints of the woodwork and the wall coverings should be considered as that the drains should be properly laid. Why is it that however luxurious and well furnished a house may be we frequently feel a sensation of fatigue when we pass an hour or two in its rooms, whereas in another we feel restful? Often I believe because the nerves of the eye are strained and wearied. And here certainly is an opportunity for the builder to adopt sanitary methods rather than unsanitary ones at practically no expense at all. Instead of the haphazard arrangements of wall-papers, without any consideration of the aspect of the room and the quantity of light which it enjoys, a very little knowledge and thought would show that neutral tints are desirable in rooms which get a large quantity of sunlight and warmer tints for north facing rooms. This consideration leads me to my next point, viz., the enormous importance of paying proper attention to aspect. The immense value of sunshine, especially in these northern latitudes, cannot be too strongly insisted upon, and in this respect it appears to me that the large blocks of artizans' dwellings which have lately been erected in so many cities lamentably fail. As a rule, particularly in the cases where the municipalities build these dwellings and the cost is charged to the rates, care is taken that all the blocks have an ample air space between them, but even with the London County Council, whose artizans' blocks are excellently designed, well-built, and with plenty of air space, the height to which they are carried makes them dull and somewhat gloomy. Of course, here again the question of cost comes in, and generally where old buildings have to be pulled down and insanitary areas cleared away, the capital expenditure becomes very large before a brick of the new buildings is laid, and in order to accommodate a sufficient number of families to obtain a rental that will give any return at all upon this expenditure, the buildings most be carried to a great height. I do not believe this can be done without prejudicially affecting the health of the inmates, especially the children. No doubt the conditions of life are infinitely superior to what obtained before, and the enforced cleanliness and general submission to regulations cannot but have an excellent effect

on the dwellers in these buildings; and the mortality is admittedly low. But I should be sorry to see these huge blocks multiplied in the heart of our great cities. The object should be to get the workers away from their work when it is finished by increasing the facilities for quick and cheap transit.

The startling development of electric traction, which is the most marked feature of these last few years, offers a solution of the difficulty. I do not think the time is far distant when it will be the exception and not the rule for the workers to live in close proximity to their work when this is performed in crowded areas, and this would result in an enormous amelioration of the average health of the people as well as a great increase in the output of their work. There can be no doubt that the success of the bold experiment, of which such places as Port Sunlight are the result, will encourage other large private firms to follow this example, and that manufacturing industries will have a tendency to be carried on at a distance from our large towns, but there must always be a large army of workers connected with the distribution and not the manufacture of commodities who will be compelled to carry on their work in the day time undersome what depressing conditions, and for these will come salvation in the shape of the tramway or the light railway. It is in this direction, combined with the erection of good small houses, amid bright and cheerful country surroundings, that I hope municipal enterprise will soon be turned. If some such policy could be carried out, just think how far-reaching would its results be. I sometimes look at the costly, well-equipped, Board Schools, which have been erected in thousands during the last 30 years, and when I see these places, as they often are, in the most dingy and depressing surroundings, I wonder how the children who attend these schools can possibly grow up healthy. Asphalted playgrounds, surrounded often by high walls, where the only view is of bricks and mortar, are not the ideal training ground for the future mothers and fathers of the people. You have only to compare the pale faces and weakly forms of the town-bred children with the ruddy bloom of those who are in the country, to see what an advantage the latter have, and I look forward to the day when all the elementary education will be carried on away from the large towns. You will think that I am wandering from my subject, but while on the question of schools there is one matter which I have very much at heart, and which I have more than once alluded to in other places, and this is directly relevant to the subject of this address. I have been speaking of the outer surroundings of our elementary schools, but turn to the inside;

these buildings are well-built and well-found in all respects, but are they beautiful? As a rule, perfectly plain walls, with no decoration on them, are all that you will find. Could not this be altered and improved at practically no cost at all to the ratepayers? There is scarcely a large city in the kingdom that has not its art school, founded by the ratepayers and under municipal control, where most excellent work is done in painting, modelling, iron work, &c. Why should not the art school students be employed in decorating the Board Schools? It would be far better practice for a student than merely designing and painting a coloured decorative frieze to be placed he knows not where, that he should, of course under the guidance of the art master, take an actual class room and decorate it well. Or why should not a modelling student design and carry out some plaster enrichments or a little statuette for a niche? It might all be done as part of the work of the session, as I said, at no appreciable cost at all. And just think of the effect on the Board School children of spending so much of every day in surroundings which are bright and cheerful and which would teach them to know and appreciate what is beautiful. Their work would be better done, their characters improved, their minds trained unconsciously, and undoubtedly their physical health would be better I might considerably amplify these remarks, but I cannot do better than conclude with a quotation from the old Greek philosopher, Plato, who says: "In the case of our artists, the bad habit must be stopped of depicting in statues or buildings or any other artistic production. what is coarse or illiberal or ugly. If a man cannot refrain from this, we must forbid him to produce anything, lest our children, if reared among images of evil as in a bad soil, drawing their impressions one by one from many sources every day, may unconsciously establish an evil precedent in their own souls. We must rather seek for artists to trace out what is noble and beautiful in nature, and thereby enable our children, like plants in a good soil, to be assisted by their environment, so that whatever meets eye or ear from these beautiful works may, like a health-bearing breeze, lead them unconsciously from their earliest years to love and be in accord with beauty and reason." These words are as true now as they were 2,500 years ago.

It is impossible to over estimate the good which has been done in the last thirty years by The Sanitary Institute, by its examinations, its publications, and not least by its Congresses, which do so much to spread abroad in all parts of the country a knowledge of the principles of sanita-

tion, and if its founders could see the results achieved, they would feel fully repaid for their exertions. But there must be no cessation of activity. Very much has been done, salient abuses have been abolished, and an excellent foundation has been laid, but the superstructure has yet to be erected. And everyone can help in the work. It cannot too often be dinned into the ears of the governing bodies that upon the health of the people depends the wealth and well-being of the nation, and the suggestions which I have thrown out will, I hope, show you that the health of the people depends upon very much wider considerations than the mere regulation of drains and ventilation, and that architecture, not only on its constructural side but on its highest and artistic side, has a closer and more intimate connection with hygiene than might be at first sight supposed.

POPULAR LECTURE

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ABSTRACT.

INSECT-BORNE PARASITES.

I HAVE to lecture to-night on a subject so large that I can only give you the principal headings just to show the latest developments of that particular branch of science which is concerned with disease and the prevention of disease. It is, perhaps, the most germane to humanity of all branches of science, especially that particular part of it which is concerned with discovery of how diseases are carried.

In the first place I would recall to your minds the many theories as to the nature of disease which have been held in former times. At first, I think, disease was attributed more or less to food, and this theory still prevails in barbarous and semi-barbarous countries. In India, for instance, almost every disease is attributed to bad rice or something like that. After that the humoural theory was developed, and here in Europe that theory held the ground for more than a hundred years. In those days they thought that everything was due to bad humours. Science, however, grew out of this stage, and then the theory was advanced, that every disease was due more or less to the elements, to the external elements, to the state of the air, of the drinking water, of the soil, and so on. Still later there came the theory that most diseases are due in some way to insanitary conditions. That theory still holds good with regard to many diseases; but with regard to the transmission of certain other diseases, we are now beginning to see further, and it almost appears as if some diseases had been created in the interests of particular little organisms called para-

sites, and that nature provides with quite as much care for these parasites as she does for man himself. I must first tell you that there are diseases due to little vegetable organisms called bacteria, and other diseases due to animal parasites—little animals in fact. To-night I must confine myself to parasites of the animal kingdom carried by insects.

I will first call your attention to the famous Tsetze Fly disease, known also as the Nagana of South Africa. It is one of the most famous insect-borne diseases and is largely prevalent in South Africa, and was one of the first proved to be carried by an insect, viz., by what is known as the Tsetze Fly. Fortunately, it is only a disease of animals and does not infect human beings. Nagana is known to prevail in other parts of Africa, and a closely similar disease is known in India and elsewhere, as Surra. Similar diseases are also found in America, where they often wipe out whole herds of cattle, of horses, and other kinds of animals. In ancient times Nagana was thought by the natives to be carried by this particular kind of fly, but it was not until quite recent years that the fact was scientifically proved by Colonel Brace of the Royal Army Medical Corps.

The disease is really caused by millions of little parasites in the blood. You cannot see them with the naked eye; but when you examine the blood of an animal suffering from this tsetze fly disease with a microscope, you see besides the blood corpuscles a little object like a serpent or an eel rushing about. It belongs to the lowest forms of animal life and is called a *Trypanosoma*, and the disease is called trypanosomiasis. The black spot which may be seen at one end of the parasite is the micro-nucleus, and from that there issues a long thread called the flagellum, and the thick part in the middle is called the macro-nucleus. The parasites move rapidly about in the blood, sometimes in very large numbers. It is a remarkable fact that one may find similar organisms in almost every rat in India. If you catch a rat, prick its tail, and take a drop of blood and examine it; you may find myriads, although the rat may be fat and well. Yet similar organisms in cattle in South Africa kill almost invariably. The reason for this difference has not yet been fully explained, but it is an interesting fact as affecting the general laws of a disease which we are only just beginning to study properly. The photograph (Plate I., p. 248) will give you a better idea of these parasites. This is a specimen of blood prepared by a process which I published the other day in the *Lancet*. It is called the dehemoglobinised thick-film process. Here are hundreds of thousands of these trypanosomas; they are just like this in the live state, and you can imagine what a vast number there must be in the whole body of an infected animal.

Quite recently Dr. Everett Dutton found a similar parasite in man. This was a most important discovery; and I should add that Dr. Ford saw the parasites before in the blood of the patient but did not recognise what they were.

We have as yet had an opportunity of studying only a few cases of the human parasite, one of which, I am sorry to say, has already proved fatal. We have still to learn whether all the cases are to prove so, as generally happens in the case of nagana, or tsetze fly disease. A second human trypanosoma has just been discovered by Dr. Castellani, who finds that it is probably the cause of what is called the "negro lethargy" or "sleeping sickness."

Now the method by which these parasites are carried from host to host is very simple. They swarm in the blood, and experiments show that if you take a minute drop of blood by means of a needle from an infected animal and put it under the skin of a healthy animal, the healthy animal will get the disease and perish. The tsetze fly simply carries this parasite in a mechanical manner as a needle might. There are other flies which carry other parasites, but not every fly is capable of doing so, because not every fly has a proboscis which can contain enough dried blood. These insects are not very different in appearance from the common house fly, though in the tropics they bite voraciously.

Now how does the infection arise in this particular disease? The infection is not carried through the air, it is not carried through the water or soil, and it has nothing to do with insanitary conditions. It is simply carried by a fly which abstracts the poison from the infected animal and inoculates it into a healthy animal.

Another point of interest in this disease is that wild animals in South Africa become what is called immune. Although they have suffered when young, and many of them perish, those that survive gradually acquire the property of throwing off the disease to some extent. Domestic animals have not yet acquired that property, and the result is that they invariably perish, for the tsetze fly, having bitten wild animals, which possess the parasites though they are immune, carries the infection to the animals which the traveller brings with him and which are not immune.

Now, to take the parasite *Pyrosoma bigeminum*. Inside are the red blood corpuscles; inside them again are the minute animals I refer to; they look like seeds, but they are really minute animals. These cause the peculiar disease known in America as Texas Cattle Fever. It kills large numbers of the herds in Texas and in other parts, and is now known to extend over many parts of the world. There are many varieties of this

little parasite. It has not yet been found in man, though we strongly suspect that it will be. The cowboys always thought that the disease was carried by a little tick called the *Boöphilis bovis*, which lives on the cattle.

Dr. Theobald Smith, a distinguished American, set to work to study the question, and proved absolutely and conclusively by careful experiments that the disease is really carried by this little tick in the following manner:—The parent tick bites an animal with these parasites in it and lays her eggs. These eggs hatch out into dozens of young ticks, and it is the young ticks that are able to carry the poison. The parent tick is not able to carry it. The young ticks live on the ground for some time, and when a healthy ox comes straying past they climb on to him and begin to bite him, and inoculate the poison into his blood. The most careful researches have failed to find the little parasites in the tick itself; but experiments with the inoculation of healthy cattle by means of the progeny of infected ticks have been repeated so frequently that it is absolutely certain the disease is carried in this manner. Fine specimens, differing slightly, have just been brought home by Dr. Christy, who was one of those sent by the Royal Society to Africa to investigate sleeping sickness. These have been found in many parts of Africa, and the natives say produce a peculiar disease. The disease has been studied, but no parasites have been found in the blood. Dr. Christy found it in another part of Africa, namely, Uganda, and it was there also associated apparently with the sleeping sickness.

Another very important and interesting parasite has been known for centuries, and is called the *Dracunculus*, or little dragon. The proper name is *Filaria medinensis*, whilst its popular name is the guinea worm. It is found in tropical countries, and lives generally under the skin of the foot. You can feel it under the skin like a thin cord. It pushes its head towards the skin, and gradually a little ulcer forms through which the head protrudes.

How does this parasite get into our bodies? How does it pass from one man to another? You must remember that all parasites must have the power of passing from one host to another host or they would soon become extinct. Nature must make an arrangement by which this parasite can do this. In this case the eggs of the animal are discharged through this little ulcer on the foot, as a rule only when the foot of the patient enters water. Thus if you pour a little cold water on the patient's foot a large number of these eggs will be seen escaping from the ulcer. These eggs consist of minute little parasites, and are seen wriggling about in every direction. They are looking for something: they are not secure

in the water because all sorts of fish and insects might devour them; so directly they escape into the water they at once begin to look out for another animal into which they can enter. One of the most remarkable things about the story of insect-borne diseases is that many of the little parasites are not content to victimise man only. They must have two hosts. They get so accustomed to living in security inside another animal that they are never happy unless they are there. So these young guinea worms immediately search for some other animal to live in, and they find a little crustacean called *Cyclops*. Through even a low-power microscope you may see these baby worms; when put into water with the *Cyclops* they at once enter the *Cyclops* by burrowing underneath its skin. They first attach themselves to the scales and then work inwards. I have been able to watch it over and over again. I have tried to make these little parasites enter different sorts of water insects but they cannot do it. For instance, they cannot enter a mosquito larva. Now the natives of tropical places do not mind having a few of these *Cyclops* in their drinking water, and are quite willing to drink insects and all. It is conjectured, then, that when a person drinks water he swallows these *Cyclops* containing the parasites; that the latter escape from the *Cyclops* during digestion, burrow into his tissues, and finally become the mature parasite. But that is conjecture at present; it has not been completely proved.

Other parasites, closely allied to the guinea worm, are the *Filaria*, and in many cases these parasites really do no harm, in fact in the tropics you will find them in every dog and bird; you have only to prick the skin of these animals and you will probably find young parasites of these filaria in the blood. But there is a very important particular species of filaria which causes disease in man. This is a most distressing complaint called Elephantiasis. In India it is called *hatika paun*, that is, *elephant's foot*. If a man is suffering from the disease in his leg it may ultimately become like an elephant's. The disease is produced by a complexity of causes, of which the *filaria sanguinis hominis* is one. If you take a case of elephantiasis and examine the blood, you will find in it many little worms wriggling about; the discovery, of which I am about to tell you, was made practically by Sir Patrick Manson. Dr. Manson could not imagine how these parasites got into the blood, and he set himself to the task of finding out. The first thing that he found out was that these young parasites occurred in the blood much more commonly at night than in the daytime, and came to the conclusion that it was because the mosquito sucks up the blood containing them. Being contained in the blood vessels they cannot escape of themselves, but must call in the aid of some foreign

agency to abstract them. I cannot tell you the whole number of reasons which led Sir Patrick Manson to come to this conclusion, but he set to work at once. He was living in Amoy in China. He had a patient with these little parasites, and he got mosquitos, made them bite the patient, and examined the blood contained in the insects. Surely enough he found the little parasites wriggling about in the mosquito's stomach, and also he found that they did something there which they did not do in the human blood vessels. The parasites in the blood of man are surrounded by a kind of loose bag which prevents them from moving about; but directly they get into the stomach of the mosquito they cast this sheath off, and are able to move about and travel along. They pass through the walls of the insect's stomach and emerge into the insect's body cavity—annoying the insect a good deal I daresay—and go on travelling and enter the thorax of the mosquito. They then begin to grow; and recently it has been found by James and Lowe that they get to the proboscis of the mosquito, and many reasons lead us to suppose that they work their way from the proboscis into a healthy person. The story would then be this: The mosquito settles on a diseased person and becomes infected from him. After two or three weeks, during which the worm is developing in the insect, the latter again bites a man, perhaps a healthy person, and passes on the parasite to him. That is a most wonderful story: it is not absolutely proved up to the hilt, from a scientific point of view, but the induction is so strong that I do not think we can resist it. First there is the infant parasite; it then enters the mosquito and grows bigger and bigger, finally into a large worm, which lies at rest in the mosquito's proboscis ready to enter the flesh of a human being to seek the lymphatic ducts, and to live there and become mature. The story is much the same as that of the guinea worm.

But I must go on to the most important parasite of all. It is smaller than these worm like objects which I have shown you; it is almost as small as the pyroplasma. It is smaller than the trypanosoma, and is called the malaria parasite. It has many forms, one of which is called the "crescent form," containing black granules within it, or the malarial pigment. I will now proceed to tell you about the disease.

First of all, just to understand the importance of the disease, consider the mortality in India alone, where, according to the statistics, something like five million deaths occur annually, a population as big as that of London is wiped out every year. What should we say in this country if some power came and stamped out the whole population of London? But this is what occurs in India every year, and nobody takes the smallest

notice. I do not think that up to the present the British Government has spent more than a few thousand pounds upon the investigation of this matter. The statistics in India are not, perhaps, strictly accurate, but for many reasons I think we may suppose that the mortality from malaria to be something like the number stated, because as a matter of fact malarial fever is the principal fever from which the natives of India suffer. But when we come to the troops, statistics are much more exact. Out of 60,000 British troops in 1900 there were 18,000 admissions to the hospital for malarial fever alone. That is by no means the full amount of sickness among the troops from this disease. From the native troops 39,000 were admitted in the year, and from the gaols 43,000. But apart from these statistics, we know that almost all the native children in certain parts of the world are infected. In West Africa between 60 % and 70 % of the native children always have the malaria parasites in their blood. Almost every traveller who goes to West Africa is attacked and suffers from it, and it is the great enemy of civilisation there. That is why malarial fever is of such immense importance, and why it is so extremely important to discover the exact route of infection.

There is a particular kind of fever called quartan fever; it comes on every four days. Another type, called the tertian fever, comes on every third day. Malarial fever is quite different from the other kinds of fever —low fever, small-pox, influenza, and so on—because it is an interrupted or intermittent fever. There is the Æstivo-Autumnal fever, a very bad kind, also a Blackwater fever, the worst kind of all. I told you that the wild animals in Africa became immune from the tsetze fly, but are still able to infect domestic animals. It is much the same in the case of human beings with regard to malaria. The wild men of Africa become immune; Europeans, the domestic men, coming among them, become infected in the same manner as the animals and die. But remember that something like half the native children in Africa perish during the first year of their lives from this disease. It is only the survivors who become immune.

The relation between malarial fever and rain has been known for centuries, and that in some way or other malarial fever is connected with stagnant water. What is the explanation of this well-established fact? the disease was long thought to be due to a miasma arising from the stagnant water, but it is now known to be due to another cause altogether, connected with stagnant water it is true, but not in the way we thought.

Now we will come back to the malarial parasite—a young one; these are leucocytes.

The photograph (Plate II.) shows a spore-producing form of parasite,

that is, one full of eggs, each of which becomes one of the young parasites. The spores break loose and are scattered, each to attack a fresh blood corpuscle.

These things first led Sir Patrick Manson to consider that malarial fever was also carried by the mosquito, as he had proved filariæ to be. The same theory had been held before by King and Laveran, and it is now thoroughly demonstrated and proved to be the case.

The photograph (Plate III.) shows the stomach of the mosquito seen by a weak microscopic power. Take a mosquito fed on malarial blood and examine its stomach. If it is of the proper species you will see on the outside of the stomach little rings. These are the malarial parasites living on the mosquito. They begin to grow in size and continue to grow day by day, and reach their maximum growth in nine or ten days after the mosquito was first fed on the patient (Plate IV.). About nine days after the insect is fed, the stomach, under a low power microscope, shows a number of parasites which have reached maturity (Plate V.); the parasites now burst and scatter their contents in the mosquito's blood.

The salivary or poison glands of the insect are very interesting, and I must now tell you a thing which I could not have believed if I had not actually seen it. The thread-like bodies actually enter the cells of the salivary gland. It is one of the most wonderful sights you can imagine. They work their way through the capsule of the gland into the cells; then they get from the cells into the channel, which is the central duct. From the ducts of the side glands they pass up into the central duct, which runs down to the extremity of the central stabbing stylet or lancet of the mosquito's proboscis. Just think of the wonderful way in which nature has arranged this matter. The mosquito first of all bites an unhealthy person and receives the malarial parasite, and the spores or progeny of the parasite, after about ten days, enter the salivary glands of the insect, and are ready to enter the blood of a healthy person. All this has been proved step by step. In a portion of the salivary gland of the mosquito the thread-like parasites are packed in numbers. You will never see these things in any respectable mosquito in England, but only in a mosquito which has been infected with the malaria parasite. So this is the story of how malaria is carried.

Mosquitos live in the water when they are young, and there are three stages: the caterpillar stage, the chrysalis stage, and the adult stage. In the caterpillar stage they live in the water. The malaria-carrying kind, as drawn at the British Museum, carry the deadly West African fever, as ascertained by the Liverpool Expedition to Sierra Leone in 1899. The

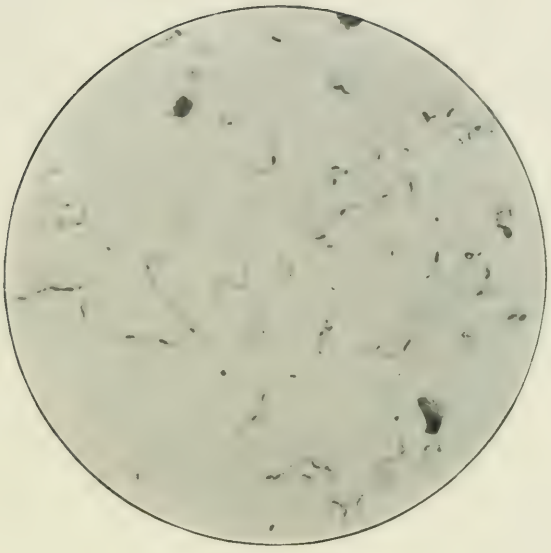

PLATE I.

Trypanosomes of tsetze fly disease.

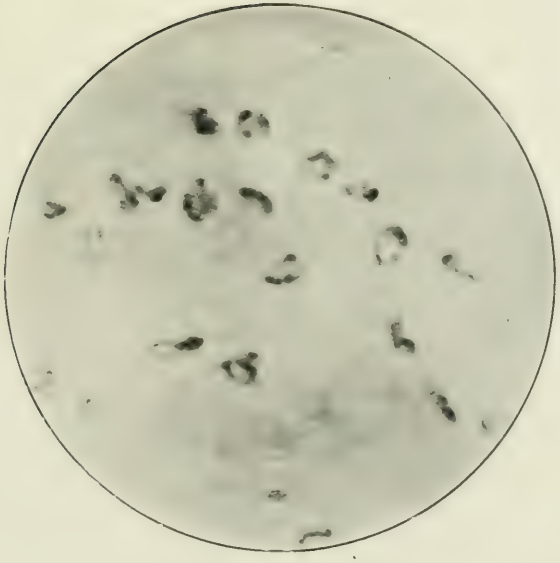

PLATE II

Æstivo-autumnal fever "ring forms" of malarial parasite, as found in a dehæmoglobinised thick-film preparation of blood (stained).
Magnified about 1,500 diameters.

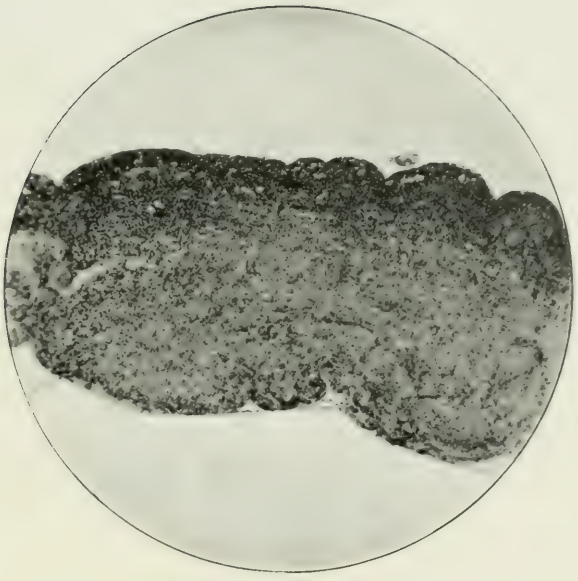

PLATE III.

Portion of stomach of mosquito (healthy) seen by lower power.

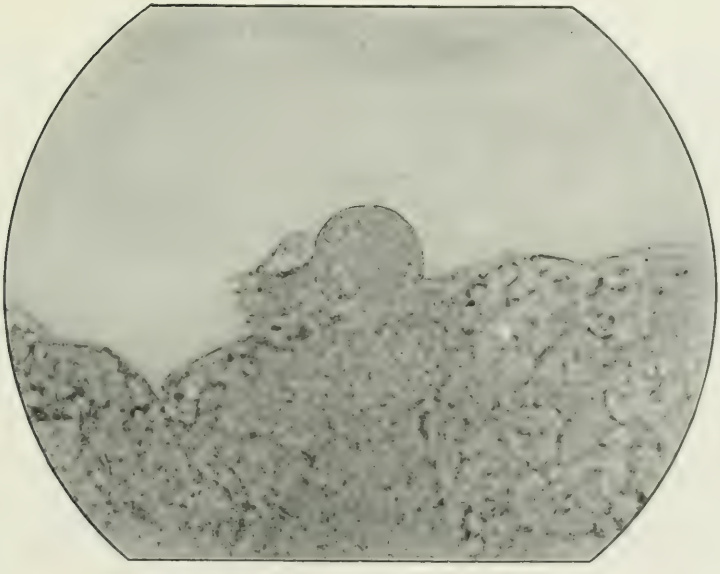

PLATE IV.

Malaria parasite attached to stomach of mosquito. High power.

PLATE V.

Stomach of mosquito infected with malaria parasites (Daniels).
Low power.

PLATE VI.

Pools where Anopheles breed in Free Town.

Anopheles, a peculiar kind which alone carry malaria, are particularly interesting, because it is only the female which bites. The proboscis is, so to speak, a case of instruments—a curved channel full of the most delicate cutting instruments. When the insect bites she plunges the stabbers into the skin and sucks up blood between them. It is the female only that carries the parasite; the male mosquito is a very delicate creature and feeds only on fruit or leaves.

The place where malaria was most intense is Free Town, Sierra Leone —the White Man's Grave. There, there used to be thousands of stagnant pools in which insects are bred. It has been our effort for the last three or four years to get some of these pools drained; the means being found by the munificence of a private gentleman who gave £2,000 to have this done. We have certainly done a good deal in that way. There is a drain running along close to the houses, and the water in the drain is so dirty that even mosquitoes will not live in it. The road in Free Town is all overgrown with grass. Sierra Leone is a most beautiful place and very rich as regards vegetation. Consider the back yard of a house, it will give you some idea of the condition of sanitation which used to prevail in Free Town. Close by we find a large puddle and perhaps a bucket. Oddly enough, malaria-bearing mosquitoes breed only in the puddle; the ordinary mosquitoes breed in the bucket. That explains why for many centuries we have known that malarial fever was connected with stagnant water on the ground, and if you come to think of it you will see how exactly science has filled up the gaps of our knowledge regarding malaria. In another puddle are Anopheles, close to a house in which natives live.

Plate VI. is a view of one of the fashionable streets in Free Town, Sierra Leone, before we came. It did not take us long to fill up puddles like these. We went there and filled up many of its puddles with a few buckets of gravel. We thought it would be the simplest way and very useful, though not permanent.

There are several small streams in Free Town, and when the streams are drying up they are full of mosquitoes; but all you have to do is to send a man once a week to brush out the drying pools and put some oil on them, which kills the larvæ at once.

The marshes on the Gold Coast, far from human habitations, are full of mosquitoes. The mosquitoes feed on the birds and beasts of the forest. The Anopheles breed in canoes in rain water which collects there; the innocent sort all breeding in tubs. The term innocent means only that those mosquitos do not carry malaria, but they do carry elephantiasis and yellow fever. Mosquitoes cannot live in the river itself, but they breed in

the reeds on the margin, and the only thing one can do in a house here is to protect the house with wire gauze; make it a kind of meat-safe in fact and live inside. In Sierra Leone we are trying to kill mosquitoes by means of oil.

I cannot conclude without adding a few words of protest. I am not quite satisfied with the way the British nation has taken up this work against malaria. It has not been smart enough, not quick enough. We have been talking about the matter for four years, and I think, considering that our countrymen are dying on the West Coast of Africa by dozens, it is high time we took some more active measures, and I propose we try to carry forward matters a little in the North Country. We are rather tired of delay; trade is losing enormously. West Africa is a country of great potentialities, and it is the disease, especially the malarial fever, which is keeping it down. Prompt and definite action on the part of the Government is urgently needed.

RESOLUTIONS PASSED AT MEETINGS OF THE INSTITUTE.

THE TESTING OF DRAINS.

At a Sessional Meeting held on December 10th, 1902, papers were read on "The Testing of Drains" by Louis C. Parkes, M.D., D.P.H.; J. Osborne Smith, F.R.I.B.A.; and W. C. Tyndale, M.Inst.C.E. At the close of the discussion, which was reported in Part I. of the Journal, Volume XXIV., pages 8–26, the following resolution was passed and referred to the Council of the Institute:—

> "That this meeting of The Sanitary Institute is of opinion that all systems of drainage for conveying sewage should be capable of resisting a pressure of at least two feet head of water."

The resolution has been carefully considered by the Council, and it was resolved:—

> "That the Resolution passed at the Sessional Meeting with reference to drain testing be not accepted by the Council, as in the form drafted it involves a principle not applicable to all cases."

NOTES ON LEGISLATION AND LAW CASES.

These notes are copied by permission from the Law Reports published by The Incorporated Council of Law Reporting for England and Wales.

For full text of these cases see "Law Reports," which can be referred to in the Library of the Institute.

ADULTERATION.—*Sale of Food and Drugs Acts—The Sale of Butter Regulations (April 22), 1902. St. R. & O. 1902, No. 355.*

1.—Milk—Inspector of nuisances—Powers—Sample procured outside inspector's district—Sale of Food and Drugs Act Amendment Act, 1879 (42 & 43 Vict. c. 30), s. 3.

The power conferred upon an inspector of nuisances under s. 3 of the Sale of Food and Drugs Act Amendment Act, 1879, to procure at the place of delivery a sample of milk in course of delivery to the purchaser in pursuance of a contract of sale cannot be exercised by an inspector outside the district for which he is appointed. McNair *v.* Cave. Div. Ct. [1903] 1 K. B. 24.

2.—Practice—Time for return of summons—Sale of Food and Drugs Act, 1899 (62 & 63 Vict. c. 51), s. 19, sub-s. 2.

By s. 19, sub-s. 2, of the Sale of Food and Drugs Act, 1899, it is provided that "In any prosecution under the Sale of Food and Drugs Acts the summons . . . . shall not be made returnable in less time than fourteen days from the day on which it is served."

Held, that fourteen clear days must elapse between the date of service and that of return. McQueen *v.* Jackson. Div. Ct. [1903] W.N. 114; [1903] 2 K. B. 163.

FACTORY.—*Escape from fire—Two factories in one house—Tenement factory—Notice to construct works—Separate notices for each factory—Owner's right to enter on occupier's factory—Public Health—Factory and Workshop Act, 1901 (1 Edw. 7, c. 22), s. 14, sub-ss. 2, 3, 7; ss. 87, 149.*

The plaintiff owned a building the whole of which up to and including the fourth floor, but with the exception of the second floor, formed one factory, and was leased to and occupied by the defendants. The second floor was not a factory. The fifth, sixth, and seventh floors formed another factory. Each of these factories produced its own motive power. The county council gave notice to the plaintiff to provide better means of escape from fire; an arbitration took place at which the defendants were not present, and an award was made to the effect that an additional staircase ought to be made starting at the level of the third floor and extending to the seventh floor, and communicating with each of

the intermediate floors. The county council served notice on the plaintiff requiring him to construct the works. The notices and the award treated the building as a whole, and did not deal with the factories as separate factories.

In an action brought by the plaintiff for an injunction to restrain the defendants from hindering him in making the staircase:—

Held, that the factories were separate factories, and that the whole building was not a tenement factory inasmuch as the occupiers produced their own power, and the building was therefore not one "where mechanical power is supplied" within s. 149 of the Factory and Workshop Act of 1901; that there was nothing in the Act which gave the plaintiff any right to enter on one of the factories in order to construct works for the benefit of the other factory; the fact that the defendants were not present did not exempt them from being bound by the arbitration; but the notices and the award ought to have treated the factories as separate factories, and as this had not been done the proceedings were ineffectual, and the plaintiff was not entitled to enter upon the defendants' premises. TOLLER *v.* SPIERS & POND, LD. Buckley J. [1903] W.N. 4; [1903] 1 Ch. 362.

SEWERS.—*"Sewer"—Drain—Drain receiving drainage from more than one building—Rain water—Metropolis Management Act, 1855 (18 & 19 Vict. c. 120), s. 250.*

Where a drain was used for drainage of two adjoining houses, not being a drain for the drainage of a block of houses by a combined operation under the order of a vestry or district board—

Held, that it was a "sewer" within the definition given by s. 250 of the Metropolis Management Act, 1855, although from one of the houses it carried away rain water only. SILLES *v.* FULHAM BOROUGH COUNCIL. C. A. [1903] 1 K. B. 829.

WATER.—*Order of Local Govt. Board, dated Dec. 24, 1902 (No. 44, 950), providing for the constitution of the Metropolitan Water Board. St. R. & O. 1902, No. 973.*

Order of the Local Govt. Board, dated Jan. 9, 1903, under the Metropolis Water Act, 1902, providing as to the constitution, etc., of Joint Committees for appointing members of the Metropolitan Water Board. St. R. & O. 1903, No. 3.

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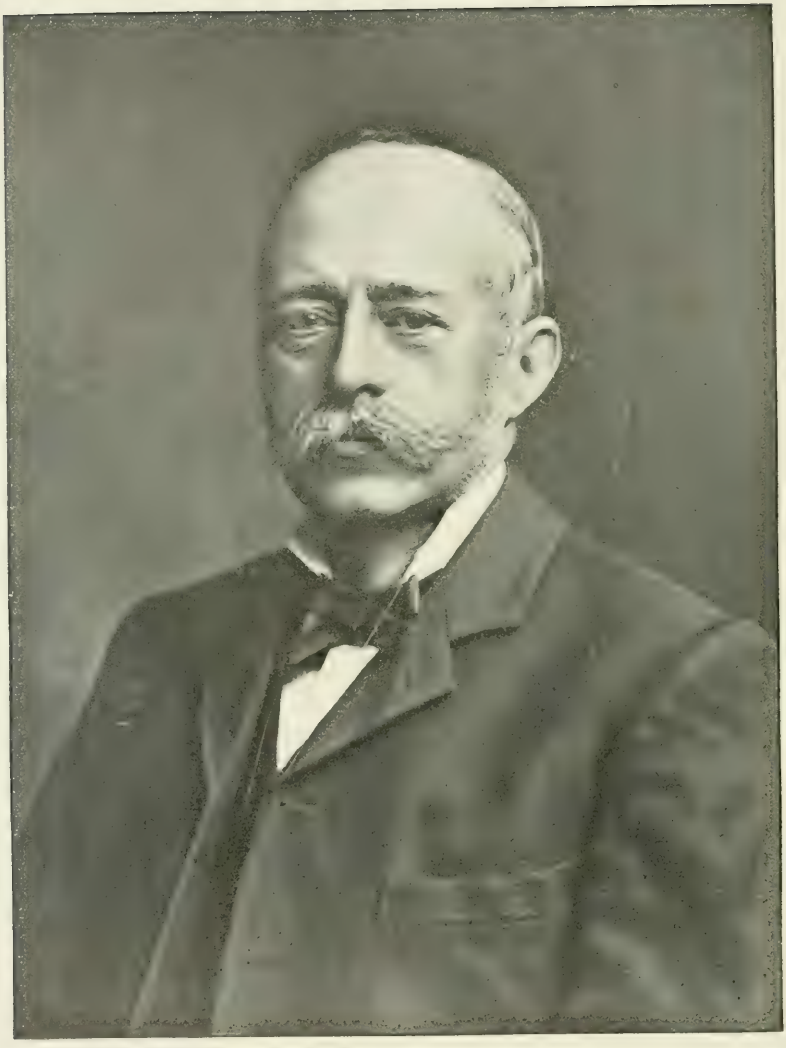

Yours very truly
W. A. Corfield

Volume XXIV.—Part III. October, 1903.

JOURNAL

OF

THE SANITARY INSTITUTE.

CONGRESS AT BRADFORD.

SECTION I.

SANITARY SCIENCE AND PREVENTIVE MEDICINE.

FOUR AND A HALF YEARS' EXPERIENCE OF THE VOLUNTARY NOTIFICATION OF PULMONARY TUBERCULOSIS.

By ARTHUR NEWSHOLME, M.D., F.R.C.P.

Medical Officer of Health, Brighton.

(FELLOW.)

THE voluntary notification of consumption was begun in Brighton in January, 1899, and the annual number of cases notified since that date has been as follows:—

	BRIGHTON.	
Year.	No. of Cases Notified.	No. of Deaths from Phthisis Pulmonalis.
1899	113	180
1900	105	173
1901	153	164
1902	224	174
½ of 1903	165	103

If it be assumed that the duration of each case of consumption is four years, it follows that over 30 per cent. of the total cases occurring in Brighton are now officially notified.

NOTE.—The Proceedings of the Section commenced with an Address by PROF. T. CLIFFORD ALLBUTT, LL.D., M.A., F.R.C.P., D.Sc., F.R.S. (*see page* 143).

Having had over four years' experience of the voluntary notification of consumption, our procedure has become fairly settled, and I am able to give a trustworthy opinion on the degree of benefit obtainable from it.

The procedure adopted is that (1) the notified patient is visited at home, or is interviewed at my office in connection with his proposed removal to the Sanatorium for open-air treatment. At this interview exact details are ascertained as to the duration and history of the illness, the possible sources of infection, places of residence during the illness, occupation and work places during the past five years, habits as to spitting, and so on.

(2) The patient's room is cleansed and disinfected when required. This is always done when a change of address occurs, or when the patient is admitted to the Sanatorium. Bedding is usually also disinfected by steam, and all these measures are carried out in every instance after the death of a phthisical patient, whether or not the patient's illness has been previously notified.

(3) The patient is instructed as to the precautionary measures required, printed cards being given in addition to exact verbal instructions. If poor he is supplied with a pocket spittoon for outdoor use, and with Japanese paper handkerchiefs for indoor use.

(4) If the patient is lodged under unfavourable conditions, and especially if he is in danger of infecting others, he is, by arrangement with his medical attendant, admitted for a month into the Borough Sanatorium.

(5) A careful sanitary inspection is made of each house in which the phthisical patient lives, and sanitary defects are remedied.

The only valid reasons that can be urged against notification of cases of consumption as a necessary preliminary to preventive measures appear to be that—

1. The above measures as to personal precautions and disinfection can be equally well carried out by the family practitioner, with the co-operation of the family of the patient, and that—

2. Sanitary inspections form part of the routine work of the Sanitary Authority.

The answer to the first of these statements is that when visiting phthisical patients I commonly find that the necessary precautions are not being taken; and the answer to the second is, that the presence of consumption in a house greatly increases the leverage in securing sanitary improvements. Very few sanitary authorities have a staff of sanitary inspectors sufficiently large to enable them to visit each house in their

district once annually. In the intervals of such visits conditions of overcrowding and dirtiness may long prevail. These conditions are much more dangerous where there is a case of consumption than elsewhere. The notification of phthisis enables such houses to be visited at more frequent intervals, which is a great gain in the interest of the public health.

I must particularly urge the fact that among poor patients, apart from instructions by the Medical Officer of Health, the necessary personal precautions are usually not being adopted, and often no instructions have been given. It would if necessary be easy to multiply instances of this.

This is a convenient opportunity for mentioning the great importance attaching to the *Early Diagnosis of Consumption*. Unfortunately many patients with bad coughs are treated for months or even years, and the tubercular nature of their illness not recognised. In Brighton the importance of the microscopic examination of sputum for the tubercle bacillus was early realised, as is indicated by the number of specimens of sputum which I have examined for practitioners in successive years. In the 14 months' 1897-8 these were 21, in 1899, 47 were examined, 86 in 1900, 125 in 1901, and 169 in 1902. The population of Brighton in 1901 was 123,478.

The measures taken under the headings (3) and (4) have made notification of consumption increasingly popular. There is a great demand for the Japanese handkerchiefs and for spittoons, and the ten beds which have been set apart for treatment of consumptives could be kept filled twice over.

THE SANATORIUM TRAINING OF CONSUMPTIVE PATIENTS.

Even when definite precautionary instructions have been given by myself, it has not infrequently been found on subsequent visits that these are not being effectually carried out. It is one thing to make the patient understand the instructions given, another to ensure that he will conscientiously carry them out. To ensure this end, the patient's self-interest, as well as his conscience, must be utilised. If he can be taught heartily to believe that his own welfare and that of his family is favoured by the precautionary measures recommended to him, we may usually rely on his co-operation. How to secure this educational influence became then an important question early in my local experience of the notification of consumption. Although a large amount of good was done by the visits to consumptive patients, there was reason to believe that some of them continued carelessly to disseminate infection in workshops, etc., by means of their sputa. After a few months' experience of sending

selected patients to an open-air sanatorium outside Brighton, I obtained, in July 1902, the consent of the Town Council to the admission of four consumptive patients into one of the isolation pavilions of our Borough Fever Hospital, which is very favourably situated for this purpose. No difficulty has arisen, owing to patients being afraid of acquiring scarlet fever or diphtheria and no cross-infection has occurred. The consumptive patients are treated on exactly the same lines as in other open-air Sanatoria.

In my report on this subject I pointed out that the cases notified to us are usually suffering from the disease in a stage at which cure cannot be expected even by three months treatment in an open-air Sanatorium; but that apart from the possibility of cure, it was in the public interest to admit Consumptive patients not living under favourable conditions at home to the Borough Sanatorium for a month or two, according to circumstances. It would diminish disease and improve the public health in three ways :—

1. The patient himself would improve in health, and be enabled to start afresh, with an increased prospect of recovery.
2. While he was in the Sanatorium, his home could be cleansed and purified, his wife and family would have a holiday, in the sense of being free from repeated attacks by the infective material causing Consumption.
3. The patient when sent home, would have been taught to so manage his expectoration that it would no longer be a source of risk to his family and to those with whom he worked.

This course was at once adopted, and before the end of 1902 the the number of beds utilized for this purpose had been increased to ten.

The majority of the patients are unable to come into the Sanatorium for longer than a month. They would lose their means of livelihood if they were absent from work for longer than that time. In a certain number of other cases, however, it has been possible to arrange for a longer treatment, and if the improvement made in the month has been such as to justify continuing the expense of the treatment, it has been continued for a second or even a third month.

Under present circumstances we are annually passing through the Sanatorium 100 to 120 consumptive patients. As the total deaths from consumption in 1902 were only 174, as each consumptive patient lives several years, and as those of higher social status are not so likely to be

the cause of infection to others, it can confidently be hoped that in a few years nearly every consumptive patient in Brighton will have had a month's practical training in the simple precautions required to prevent him from being a source of danger to others.

From the above statement it will be gathered that the curative aspect of Sanatorium treatment is regarded as of secondary importance. We are chiefly concerned with educating these patients, and thus avoiding risk to others. At the same time they have a practical personal demonstration of the benefits to be derived from abundant food, an open air life, and freedom from infective dust. When they leave the Sanatorium at the end of the month, which in the majority of instances is the limit of time, they are without exception ardent advocates for the fresh air *régime*, and I have not yet come across a single patient out of the 71 thus treated (to June 25th, 1903) who after leaving the Sanatorium has again become careless as to coughing and expectoration; and this notwithstanding the fact that only a minority of the patients leave us without expectoration. They have so far improved in health that they are most eager to continue the *régime*, so far as their means will allow.

It appears to me that in connection with Sanatorium treatment too much stress has been laid upon the cure of the patient. Such cure must be exceptional unless the treatment can be continued for six or more months, and unless it can be begun earlier in the disease than the stage at which cases of consumption are usually notified. Each of our patients is informed before he is admitted to the Sanatorium (unless the disease is at its earlier stage) that a cure is impossible in the time during which he will be treated, but that he will have a thorough holiday and rest under excellent conditions, and that he will be taught how to manage himself so that when he leaves he can, so far as his means admit, continue the treatment, and can pursue his daily life without risk to his relatives or fellow workmen. It is made a *sine quâ non* that as soon as the patient is admitted to the Sanitorium his house shall be thoroughly cleansed and disinfected. When he returns home therefore both he and his family are freed from the risk of infection by old infective material.

The educational aspect of Sanatorium treatment, as developed above, is more important in the public interest than its curative aspect. The majority of cases are notified in the second or even in the third stage of the disease. The natural history of consumption is, as is well known, one of repeated exacerbations with intervals of quiescent disease. During the quiescent intervals the patient, if belonging to the artizan and labouring classes, resumes his work, and so is a continuing source of danger not only

to his family but also to those employed with him. Hence it is of the utmost importance that, although there may be extensive disease, the patient should receive that practical instruction in the management of his expectoration, and should receive that practical demonstration of the benefits which will accrue to him personally which, in most instances, can only be secured by a temporary residence in a well-managed Sanatorium. Our rule in selecting patients out of excess of applicants over available beds is to prefer (1) men to women, and (2) those still able to work; because, as a rule, by treating and training these the circle of good achieved is wider than when we treat and teach those with a more limited environment. There are exceptions to this rule. Several instances could be quoted in which the mother of a large family suffering from chronic consumption has infected every child in succession, while she has remained able to carry on her family duties. Hence a certain number of selected female patients are admitted when we have beds available for them.

That the educational aspect of sanatorium work is overlooked by many is shown by the remark made by a Metropolitan Medical Officer of Health*: "It is questionable whether, in London, sanatoria would be of very much good to the poorer classes. What would be the use of discharging a patient from a sanatorium and sending him back to Battersea?" It is just in such an instance that the maximum good would be achieved. The patient might not improbably relapse after his return home; but if the sanatorium treatment had been intelligently given and received (and my experience is that the working classes are most intelligent in receiving instructions as to their health) he would not continue to be a serious source of danger to his relatives and fellow-workmen. The essential cause of consumption is the tubercle bacillus. Furthermore dosage is an important element in the infection of this disease. The trained patient, even under the least favourable home conditions, is a much less serious cause of risk to others than he was before he had the benefit of sanatorium treatment.

The Relative Importance of Different Measures for the Prevention of Consumption.

A similar line of fallacious reasoning has led one Medical Officer of Health to place on record the statement that: "It may safely be said that a given sum of money invested under the provisions of the Housing of the Working Classes Act will do more towards the permanent reduction of the death-rate from phthisis than many times the same sum expended

* "Public Health," March 1903, p. 321.

on the building and support of sanatoria."* Such a statement would scarcely be made by anyone having experience of the Housing of the Working Classes Act, and who knew how expensive and relatively unproductive and unsatisfactory are such schemes in the majority of districts, even when it is imperative to carry them out. The enforcement of the law as to over-crowding and as to the dirty interiors of houses, has undoubtedly had great influence in diminishing the mortality from consumption; but the operations of the Housing of the Working Classes Act throughout the country have been on too small a scale (in the majority of districts there has been no action whatever under these Acts) to have much bearing on the question.

It is important to preserve a sense of perspective in our preventive measures. Consumption is caused by consumption, and cannot occur apart from the existence of a previous patient suffering from this disease. The tubercle bacillus is not ubiquitous. It haunts the vicinity of the consumptive. The acquirement of consumption depends on three factors—infection, susceptibility and environment. In certain families proclivity is so strong that environment becomes completely subordinate. The members of such families will acquire consumption when living under the best conditions as to housing and work if they are exposed to infection. Numerous instances of consumption occurring under the best sanitary and social circumstances must be known to us all. In others susceptibility needs to be increased by unfavourable environment before infection (unless it be frequent and large-dosed) can take root. The vital resistance is lowered by attacks of other diseases, by debauchery, by fatigue, by overcrowding or by want, or by combinations of these influences. Of the diseases which most lower vital resistance, probably alcoholism and influenza in the adult, and whooping-cough and measles in children, hold a chief place. With the exception of alcoholism, almost the entire community is at times subject to one or other of these causes of lowered resistance to disease. Furthermore, the fact that in 30 per cent. of a large series of autopsies evidence of tubercular infection was discovered shows that a certain amount of tubercular disease is recovered from by a very high proportion of the total population. That they have recovered may be considered good evidence of partial insusceptibility. It is equally good evidence of serious exposure to risk, from which we should all be glad to free those in whose welfare we are deeply interested.

The registered mortality from consumption has declined to the extent of

* "Public Health," April 1903, p. 393.

about fifty per cent. in the last fifty years; and this is regarded as sufficient evidence that general sanitation, apart from direct measures against infection, will suffice for its extermination. I have shown elsewhere* that owing to lax statements as to the causes of death in the early registration years, and the increasing tendency in recent years to return deaths as due to "tuberculosis" or "general tuberculosis," which would formerly have been returned as phthisis, there has been some exaggeration of the decline of the phthisis death rate. It must be remembered also that among the agencies which have caused the improvement already secured, some of the most important have directly diminished the opportunities for infection. Improvements in housing and diminution of overcrowding, undoubtedly have had this effect. The improved habits of the people have had the same effect to an even greater extent. Quite apart from the present crusade against spitting, there has been an immense improvement in domestic habits in this respect and in general domestic cleanliness, which must have had a material effect in diminishing opportunities for infection.

At the same time I do not wish to minimise the importance of indirect means for preventing phthisis. Opinions will doubtless differ as to the relative share which direct infection by means of spray during coughing or by dried expectoration on the one hand, and dirty over-crowded damp dwellings on the other hand, play in the causation of Consumption. The wise hygienist is he who attempts to control both sets of factors.

Sanatorium treatment itself is the best testimony to the importance of these indirect means of preventing consumption. The patient lives an almost completely out-door life; he is brought into a condition of high nutrition, and is freed from any fresh external infection. While emphasising the importance of the last cause of improvement, I realise that of improved nutrition and aeration. Much of the reduction of consumption in the last half century has probably been caused by the cheaper and more abundant food which we have owed to the abolition of the Corn Laws. Poverty and consumption are inseparable companions, for if infection causes the disease poverty furnishes the appropriate soil, besides increasing the closeness of contact and frequency of opportunities of infection.

(For discussion on this paper see page 275.)

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* Elements of Vital Statistics, 3rd ed., p. 239.

TWO YEARS' EXPERIENCE OF THE VOLUNTARY NOTIFICATION OF PHTHISIS IN THE METROPOLIS—AND ITS LESSONS.

By HENRY R. KENWOOD, M.B., D.P.H.,
Medical Officer of Health, Metropolitan Borough of Stoke Newington
(FELLOW);
And GERARD C. TAYLOR, M.D., D.P.H.
(MEMBER).

AS the result of about two years' experience of the voluntary notification of consumption in London, we are impressed with the fact that although some good has undoubtedly been achieved thereby, there is a great need for the adoption of further measures.

The voluntary notification of the disease enables the sanitary authority to deal with a very limited number of cases. During the year 1902, for instance, we received only one notification of this disease to every 2,000 of population; whereas there must have been in the borough at least ten times as many cases, and the majority of these would have derived some benefit from one or more of the following lines of action taken when a notifiation certificate is received: —

1. An investigation of the surroundings of the patient, the conditions of work, etc., with the object of detecting and removing those conditions likely to favour the disease.
2. The leaving of a handbill of instruction and advice.
3. The gratuitous supply of disinfectant, when necessary or advisable.
4. Periodic visits to see if the precautions advised are carried out.
5. The compulsory cleansing and disinfection, where necessary.

It is doubtless a great pity that the sphere of this useful work should be limited to the few cases voluntarily notified, and it is therefore very desirable that the notification should be made compulsory.

Voluntary notification is to a great extent a makeshift, but it has served a useful purpose by educating public opinion so as to prepare it for a measure of compulsory notification. The public is now ready for such a

measure. Nothing has been more surprising than the circumstance, that in *every one* of the houses visited, the patient and those about him were found to be fully aware of the communicability of the complaint.

If the fear of infection has gained too great a hold of the public mind and there is a tendency to exaggerate the comparatively slight infectiousness of the disease, doubtless this is better than to err in the other direction. There is the risk, however, that it may lead to unnecessary hardship in the treatment of the patient, consequently it is most desirable to point out to all concerned, as is usually done in a handbill, that if a few simple precautions are taken a consumptive patient need not be a source of danger to anybody.

The effect of compulsory notification would be not only to increase the number benefited, but also to bring about earlier notification. Under voluntary notification we have found nearly all the certificates received were of advanced cases, either attended by the parish doctor or seeking assistance from the public dispensaries; the few exceptions chiefly referred to patients in extremis or dead. The patient who at the start of his illness is in fairly comfortable circumstances is rarely notified until, owing to prolonged illness and consequent lack of work, he falls within the above category.

Too much, however, must not be expected of even compulsory notification. It is only one of our weapons in fighting the disease. The hope of extirpating phthisis is impossible to realise. The exigencies of life do not permit the vast majority of people to live under ideal conditions, and selfishness, ignorance, or poverty will always maintain sources of possible infection. But no reasonable step should be neglected that will lead to a lessening of these sources of infection. There is no doubt that much good results in many instances, both directly and indirectly, from notification, and some occasional inconvenience or annoyance to the individual who is a probable source of infection must not be allowed to stand in the way. At the same time, one has no right to interfere with the individual's liberty of action so long as it does not jeopardise the health-interests of others, but when others are thereby exposed to considerable risks, it should be possible to secure isolation of the patient.

Notification is mainly beneficial in the case of those who, owing to lack of means, are unable to adopt the necessary measures to protect others. This fact dominates the whole subject of the notification of the disease, and therefore the matter is dealt with in this paper almost entirely in its application to the poorer section of the community. The better class patients are almost negligeable quantities. They can be isolated at home

under the directions of their medical attendants and need not be a source of infection. The subject of the compulsory notification of the disease is too often discussed, by adverse critics, as if it mainly affected the middle and better classes, who, it is alleged, would resent all our interference. It affects them to a relatively *very* small extent, and almost all our action would be taken among the poorer classes who have already shown a high appreciation of the importance of preventive measures.

It is essential not to lose sight of the fact, that although consumption may be classified as an infectious disease, it differs from all other dangerous infectious diseases in two respects, which demand due recognition at the hands of public health administrators. We refer to the long average duration of the disease and to the facility with which infection can be limited. If, in any scheme of compulsory notification, sufficient allowance is not made for these facts, then we do not favour the measure, and we are confident that so much opposition would be met with at the hands of medical practitioners and the general public, that, if so be it were ever adopted, its value would be much restricted.

In our opinion, therefore, this disease ought not to be dealt with on all fours with other notifiable diseases, and we would advocate the following provisions in a short Act.

1. Compulsory notification of all cases by the medical practitioner in attendance.

   The certificate form to contain special questions to be answered where a private doctor is in regular attendance. (This will frequently obviate the necessity for a call on the part of the medical officer of health, and unnecessary interference by the Sanitary Authority.)

2. Power on the part of the Sanitary Authority to insist on isolation at home or in hospital, for so long as necessary, in special cases when the medical practitioner and M.O.H. are agreed as to the necessity.

3. Expressly stated powers to insist on the cleansing and disinfection of premises whenever necessary, and on the invariable disinfection of sputum.

In the majority of cases visited we have been able to make suggestions for improving the existing arrangements and reducing the risk to others, but it has often happened that a patient in the last stages of the disease has had to occupy a room shared by several. In these cases no suggestion which we were able to make could do away with the enormous risks the other occupants were daily called upon to face.

What is therefore urgently required is that some provision should exist in each sanitary district in London and elsewhere for the isolation of those cases which are a source of great danger to others. It is impossible to get them into the sanatoria for consumption which at present exist, for many are patients who will certainly never recover, and they are almost paupers.

Dr. Kelynack writing in *The Hospital* of April 25th last, summarises the present sanatorium provision in the United Kingdom. From these returns it appears that for the free accommodation of consumptives in sanatoria constructed and conducted on modern lines, there are less than 150 beds available. The special hospitals of London providing free accommodation for such cases have something like 665 beds at their disposal. This statement does not, of course, include the general hospitals, into which many phthisical cases are still admitted, although there is a growing reluctance to admit them, especially in the later stages of the disease. The special hospitals and sanatoria admitting paying cases at rates at all within the limits of members of the working class have about 400 beds. Phthisis is a common cause of pauperism, and many consumptives, it is true, find their way to the workhouse infirmaries; but not as a rule before the disease is in a hopelessly advanced stage, and they have doubtless in many cases already infected others.

The crowded home is thus the only place available for the very large majority of the poorer consumptives, who, from the circumstances of their poverty and surroundings constitute themselves *the chief centres for the spread of the disease.*

At the present time it seems to us that we are running a little wild on the subject of sanatoria. We are spending almost everything on what are essentially curative institutions for less advanced cases, and neglecting to make provision for isolating dangerous cases, and thus protect others from a disease which, *among the poorer classes*, is seldom cured when once contracted. Sanatoria, in which the cure of the disease is the prime consideration, are therefore of secondary importance to the community as compared with homes for the isolation of those who, though a source of great danger to others, cannot be isolated in their own homes.

The number of notifications we have had to deal with has been small, and it would therefore be easy for the returns of another two years to furnish somewhat different results, but a further illustration of the paramount importance of the preventive measures as compared with the curative, *among the poorer-class sufferers who are voluntarily notified*, is afforded by the following gloomy facts:—

Those dead at time of first visit	...	...	8 per cent.
„ „ within one month of notification	...	24	„
„ „ „ two months	„	... 33	„
„ „ „ three „	„	... 37	„
„ „ „ one year	„	... 46	„

Some improvement had taken place in only 8 per cent. Of the remaining cases, 10·5 per cent. had left the borough and could not be traced, and only 6 per cent. of all those notified had at any time been admitted to sanatoria or special hospitals.

To furnish a good prospect of cure, treatment in a sanatorium must be prolonged, and a very lengthy stay is generally impossible for the class we are considering, but the hygienic manner of life inculcated in such institutions during a few months residence is of value in those cases where they are able and willing to practice what they have been taught. But those who are patched up by a temporary residence of a few months only, generally relapse on resuming their work and returning to their former surroundings. In rare cases the permanent cure of a poor-class patient is effected, but exact data as to the immediate and *remote* results of the sanatorium treatment *of the poorer classes who resume their previous occupations and surroundings* would demonstrate a very restricted usefulness of curative institutions for this class.

An economic error is committed by any community which erects institutions for the treatment of what are, generally speaking, the less dangerous cases, with at best a poor prospect of cure, while doing nothing for the isolation of the more dangerous cases which may be responsible for the infection of many fresh units. For there is no malady to which the dictum "prevention is better than cure" applies more aptly.

In short, institutions are wanted which are not provided primarily for the benefit of the patient, but for the isolation of the patient for the benefit of others, and which may therefore fairly be supported out of public funds. There are no such institutions in London, and until they are provided we lack one of the most essential provisions for coping with the disease.

It is a provision strictly comparable to our present fever hospitals, which are constructed primarily to check the spread of disease, and therefore the same authority should provide isolation homes for consumptives; moreover, having regard to the enormous pecuniary loss which the disease annually entails upon the State, some State assistance should be obtainable where necessary. We do not, however, advocate the needlessly extravagant expenditure upon such institutions which appears to be a fashion at the present day.

(For discussion on this paper see page 275.)

ON THE NOTIFICATION OF PHTHISIS IN MANCHESTER.

By JAMES NIVEN, M.A., M.B.,

Medical Officer of Health, Manchester.

(Fellow).

IN 1899 the Manchester City Council approved of a report presented to it by the Sanitary Committee recommending the adoption of a system of voluntary notification of phthisis. This report provided a complete scale of fees for notification, and stated the objects in view. These were in brief, the carrying out of an administrative scheme under which the homes of consumptives were to be visited, and the members of the family instructed what precautions must be taken to avert infection. Infected rooms and articles were to be disinfected. The sources of infection were to be investigated with a view ultimately to arrange further measures of prevention. It was anticipated that any successful action would be followed by hospital provision for cases of phthisis from crowded homes.

Provision was made for the appointment of Assistants to the Medical Officer of Health, to carry out the investigations and administrative measures indicated.

The work was begun in September, 1899, when Dr. Coates, now Medical Officer of Health of Burton-on-Trent, was appointed as Assistant. At that time notifications were invited only from public institutions, as it was considered advisable to work out the administrative measures required under only a moderate pressure of work. In the beginning of 1900, however, Dr McCleary, now Medical Officer of Health of Battersea, was appointed a Medical Assistant, and notifications were invited from private practitioners.

This scheme of administration originally planned out was found to answer very well in practice, and has been but little modified.

When a notification is received, an inquiry form containing numerous particulars, on which has been inscribed the details contained on the notification form, is handed to the assistant medical officer, who visits the

case, makes a report on the possible sources of infection and on the measures of disinfection to be carried out. He also gives personal instructions to the consumptive and to the friends of both. If a spit bottle is to be supplied he enters this on the form. He also arranges about the forwarding of specimens of sputum to Professor Delépine, should this appear to him to be necessary.

On returning to the office he hands his form to the principal clerk in the tuberculosis office, who prepares directions to the health visitors and to the sanitary inspectors as to subsequent visits to the house. It should be mentioned that these subsequent visits are paid by the health visitors of the Manchester and Salford Ladies Health Society, generally once a month, over the area covered by the operations covered by the Society, and by the sanitary inspectors over the rest of the city. The measures of disinfection to be carried out on the instruction of the Assistant Medical Officer of Health consist partly of washing the walls, ceilings, floors and furniture with a solution of chlorinated lime of an ascertained strength, articles of clothing being disinfected by steam in the Corporation disinfector.

In a considerable number of instances, embracing the majority of those in which the patient has been carrying out sufficient personal precautions, the rooms presumed to be infected are disinfected as to the walls and furniture by rubbing down with dough, the floors being scrubbed with soft soap, soda and water. In many instances this form of disinfection is carried out by the Corporation.

As far as possible, disinfection is supervised by the health visitors and by the sanitary inspectors.

Periodic visits are paid by the health visitors and sanitary inspectors to see that the houses are kept clean, and that the precautions recommended by the Assistant Medical Officers are carried out. It may be mentioned that the health visitors had, last year, the benefit of a month's instruction from Mrs. Crosbie in the best manner of carrying out their work.

Advantage is taken of the information gathered with respect to the occupations of the patients, to communicate with the masters of factories and workshops, with a view to having notices suspended in the different workrooms giving directions with regard to expectoration. It may be said that this has been done on a very extensive scale.

Notices with regard to spitting have also been suspended in the common lodging-houses and public-houses. In the former, which are under the control of the police, they remain, but in the latter they have largely disappeared.

During the years 1900 and 1901 a number of consumptive patients

from crowded houses were treated in the Small-pox Hospital, and, on the whole, did fairly well. Generally they put on weight for a time, being judiciously fed, but the improvement was not in all cases sustained. Nor could this well be expected.

Provision for the reception of consumptives is quite essential, if notification is to be a success. For not only are centres of infection thus isolated, but the patients, if they are fortunate enough to be able to return home, carry with them a thorough knowledge of the precautions necessary, a matter of great importance when it is remembered that they come from households specially exposed to infection.

Moreover, the prospect of getting admission to a hospital renders many of the patients more willing to have their illness notified, a matter of considerable moment, in this as in other infectious diseases, in securing notification of cases.

We are in hopes that ample provision of this character will be made for Manchester before another year is over. Meantime, two houses, capable of comfortably accommodating 16 patients, have been fitted up for the purpose within the extensive precincts of the small-pox hospital, but have had, during last winter, to be used for the reception of cases of small-pox.

How far consumptive patients will agree to the conditions necessary for their reception into this home remains to be seen, but it is expected that other and more ample accommodation will be found.

I calculate that 100 beds would cover the needs of the city in this particular, that is to say so far as concerns the reception of those more dangerous cases which threaten to infect their families for one or another reason.

Various investigations have been made in connection with the Department. Dr. Coates carried out in 1900 an investigation into the extent to which houses had become infected from the presence of consumptives. The bacteriological work was done in Professor Delépine's laboratory, and under his direction. It was a very careful piece of work, admirably executed, and confirmed in all particulars Cornet's work.

The measures of disinfection mentioned were at the same time tested, and it was found by Dr. Coates that both the applications of chlorinated lime, and the use of dough, under the conditions mentioned, were adequate to entirely remove tubercle bacilli.

Another Assistant Medical Officer, Dr. Beatty, now Medical Officer of Health for Northampton, investigated with great thoroughness the question how far the measures carried out could be shown from the records, backed

by special personal inquiry, to insure that the houses occupied by consumptives when disinfected had become innocuous to the inmates, and incidentally whether they had caused phthisis when they had not been so disinfected. The conclusion at which he arrived agreed with the previous experimental inquiry in showing that the disinfection carried out had been effective.

In the course of last year the records of the office were utilised to assist in measuring the influence of various occupations in the production of phthisis. A summary of this work, but without the tables, is published in the *British Medical Journal* of Sept. 13th, 1902. It appeared that various factors are at work in the production of occupational phthisis, prominent amongst which are intemperance, especially when conjoined with the frequenting of public-houses, spitting in the workrooms and closets attached, high temperatures, and abundance of dust generated in the course of the work. It appeared probable that the last-named cause would produce, in general, a very much less effect if the other causes were absent.

There appears to be little doubt that the administrative work now being steadily pursued in Manchester is producing a decided effect. But there are two directions in which its value could be greatly increased.

One is the compulsory notification of phthisis, and the greatest credit is due to the Corporation of Sheffield, which has pioneered this advance in their new Act, although they have at the same time had the misfortune to lose their Medical Officer of Health, Dr. John Robertson. This departure will entail a great increase of administrative work, however, if the increased notifications are to be properly used, and it will also require judicious guidance.

The other is the provision of isolation in hospital for infective cases, more or less advanced, from crowded households, to which in the judgment of the Medical Officer of Health, they are a source of danger. The recent work done in this direction by Dr. Arthur Newsholme, as recorded in his annual report for 1902, is full of promise.

I will merely remark, in conclusion, that in addition to the administrative work done, a large amount of material has accumulated in the office, which, owing to the excellent arrangement of the material by Mr. Lock, the principal clerk, is immediately available for purposes of investigation, or for tracing the source of infection, so far as this can be done under a system of notification which embraces, at a rough estimate, only one-third of the well-marked cases of phthisis in the city.

The work which may be done by the Friendly and other Insurance Societies:

During the Congress on Tuberculosis in 1901, Mr. Frederick Hoffmann read a paper which attracted a considerable amount of attention. He was not at that time favourable to the establishment of sanatoria by insurance societies; and, in his view, without state aid such an idea was impracticable. But, on the other hand, he believed that assistance might properly be given by insurance societies to sanatoria already established.

At the last annual meeting of the Conference of Friendly Societies a report was presented on this subject by the delegates of the societies to the London Congress on Tuberculosis held in 1901. The gist of this report was that it was lawful and desirable for the societies to levy a rate for the purchase and maintenance of beds for their members in existing sanatoria for consumptives. In any case it is manifest that Friendly Societies might give an immense extension to the diffusion of knowledge on this important subject, as suggested by Mr. Hoffmann.

Appended is a memorandum for the use of Friendly Societies, containing suggestions and advice to insured persons, which might be distributed after such alterations as their medical advisers might suggest.

Memorandum for the Consideration of Friendly Societies.

We beg to bring to the attention of insurance societies a very able paper, read at the Congress on Tuberculosis held in London in 1900, by Mr. Frederick L. Hoffman, who supports his views by very extended life insurance statistics. It is not necessary to give Mr. Hoffman's paper *in extenso*, and we propose only to mention those facts which intimately concern insurance societies.

In Table VI. he illustrates from insurance experience the very high percentage of deaths occurring from tuberculosis at the earlier ensured ages—exceeding forty per cent. at ages 20–24, 25–29, and 30–34.

In Table XI. he shows that the percentage of all deaths from consumption in the insurance experience occurring within the first three years of insurance is higher than the percentage of the total deaths from eight other causes occurring within the first three years.

In Table XII. he shows that the percentage of deaths from consumption occurring within the first three years after insurance is much higher amongst those not medically examined than among those medically examined.

In Table XIII. he sums up in the following statement: "While on the

average we have received $24 from those who died from consumption, we returned to the beneficiary over $134, a net loss of about $110 on every case, or more than half a million dollars in the course of a year."

Mr. Hoffman is able to give the history of 40,000 applicants for a second insurance policy, who were rejected over a period of twelve years, and whose history was endorsed on the first policy. Of those rejected for all causes 22·8 per cent. of the males, and 20·8 per cent. of the females had died by Jan. 1st, 1900, while of the males rejected on account of family history only 9·1 per cent., and of the females rejected on account of family history only 9·5 per cent. had died. This he takes to mean, what is undoubtedly the case, that the importance of family history has been greatly overrated.

On the other hand, of the deaths among the males rejected for family history 57·8 were from consumption; among the females 61 per cent. were from the same cause.

Of the deaths amongst those rejected for all causes, on the other hand, only 22 per cent. of the males, and 16 per cent of the females were due to consumption.

Thus while the entire part played by family history is not great, consumption is more important than the other causes. But it is probable, as Mr. Hoffman justly observes, that this is in the main due to exposure to infection, which is more likely to occur where there is a family history.

Physical condition at the time of insurance is of great importance in relation to the probability of the insured contracting consumption, as determined by the girth of the chest on inspiration and expiration, weight and height. A low proportion of weight to height is of special significance.

Mr. Hoffman lays very great stress on the careful selection of applicants, on physical culture, and on the precautions which they should be taught to observe.

He believes that a not inconsiderable number of those who die early after insurance have already got the disease in their system, and that careful medical examination would reveal that such was the case. The points on which he finds that medical experts lay special stress are rapidity of pulse and rise of temperature.

To this he would add light weight in proportion to height. Loss of sleep is another symptom, we may add, of some significance.

It must be admitted, however, that these symptoms, even when present, are of doubtful applicability. Other early signs are the occurrence of night sweats, loss of vigour, rapid breathing and pains in the chest.

Mr. Hoffmann does not see how it is possible for insurance societies to build and maintain sanatoria, though he by no means under-estimates either their value or the need for them which exists.

He is of opinion that insurance societies could do an immense amount of work through their numerous agents in the way of educating persons insured with them in the laws of health, in this way benefitting at once the insured and the societies.

Towards the close of his paper he sums up the directions in which he would like insurance societies to act, in the following manner.

In these ideas we agree with Mr. Hoffmann, and we suggest that the insurance societies should issue some clear instructions to the following tenour. If they approve of the instructions which we have drawn up in a general sense, they might usefully be submitted to a medical sub-committee for revision.

Instruction to the examining medical officer:—

1. An applicant should not be rejected on family history.

2. If, however, the family history is accompanied by a poor physique, the applicant should be rejected.

3. If the physique be fair, but there is a history of exposure to infection in the home, insufficient precaution being taken, the application should be deferred. The questions asked should be such as to reveal the presence in home of probable cases of phthisis.

4. In any case, where a clear history of exposure to infection at home is obtained, the insurance should be deferred.

Instruction to the insured:—

When an applicant has been accepted, or his insurance is deferred, he should receive the following paper of instruction:—

1. In order to retain health, you should lead a healthy life, as far as practicable.

It is best to avoid alcohol altogether, whether as beer or spirit, so that you may be able to spend as much as possible on clothing and food, and on pleasures which extend to others.

In any case, anyone who cannot stop at two glasses of beer, or one glass of whisky a day, should not taste either.

The lungs of those who drink much are thereby made specially liable to infection, and as a matter of fact, heavy drinkers suffer a high death-rate from consumption and other chest diseases.

This is partly because many persons, of whom not a few do not drink heavily, frequent public houses, clubs, and theatres, in which spitting is freely practised. It is impossible for an unskilled person to distinguish the expectoration of consumptives or of others suffering from chest disease from the spit of healthy persons.

All public houses, clubs, and theatres, therefore, which are not kept scrupulously clean and free from expectorated matters should be carefully avoided.

It is owing to excessive indulgence in alcohol, especially in infected places, that many fine strong men contract consumption or inflammation of the lungs and die young.

2. *Diet.* Persons engaged in heavy work should eat heartily. This is equally applicable to men and boys doing much work, whether manual or in going about, and to women, whether their work is in the factory or whether it be in bearing children and looking after them. A woman in child who does not get the food she wants, or, from any cause, cannot eat well, is partly starving her infant and partly is parting with her own body to nourish its growing frame.

All girls should learn how to cook and how to make cheap food go as far as possible.

Having regard to their nutritive value the following are cheap foods:—Amongst the cheapest is good whole meal, bread, oatmeal, barley, peas, and lentils. Herrings are cheap. So is cheese. Good meat may be obtained fairly cheap. Poor meat is not cheap.

Not a wide range, but eked out with bones and a little meat a good deal of change can be rung upon it.

Good potatoes are not particularly cheap, but are not dear, having regard to their properties, when taken along with other foods, as meat or herrings.

All food should be thoroughly cooked and very well chewed, so as to make it go as far as possible.

3. *Clothing.* Warm clothing must be woollen or flannelette. Flannelette is dangerous because of its liability to take fire. The property of making the person warm is entirely dependent on the cleanness of clothing. Dirty clothes cease to protect against cold.

People are advised that for health the bedroom window should be left open to admit fresh air. But this can only be done, even with well-fed people, when the inmates of the bedroom are kept warm.

Therefore, an adequate supply of warm bed clothes in winter is necessary if the windows are to be open, and in addition an earthenware bottle filled with hot water and covered with a piece of blanket, is advisable. This does not cost much.

Cold air cannot usefully be admitted unless the body is kept warm.

4. *Occupation.* In many occupations the lungs are exposed to special danger, but from a great variety of causes.

Where the cause is the prevalence of injurious dusts, there the dust should be especially removed by ventilating fans, and the wits of workmen should be constantly at work devising means by which this may be effected.

But in other occupations the injury is inflicted by impure air, which can only be removed by specially devised means of ventilation. In a great proportion of our workshops there is a vast amount of injury inflicted by spitting or expectorating on the floor of the workshops or of the closet. This habit, insuring workmen should sternly put down, as there is nothing which is more dangerous to health than the habit of expectorating on the floor of the workshop.

It is necessary for all persons engaged in hard work to realise that they are drawing much more air into their lungs during work than during resting hours, and that the workshop should therefore be at least as safe as the home.

5. *Exercise.* The most important function of exercise is to expand the lungs and keep them in good working order.

The same advice, therefore, is not applicable to an iron worker and to a clerk.

An iron worker requires fresh air in his leisure, so that his powerful lungs, developed by exercise, may not inhale injurious materials. But he does not need to study the action of his lungs.

A tailor and a milliner and a shoemaker do need to study this subject, occupying, as they do, a sedentary—or, at all events, a stationary—position during the day. Probably the best exercise for them is a walk in the open.

Further, they should study the expansion of the chest. They should, therefore, make a practice of breathing deeply.

For clerks and shopmen, again, who have little exercise during the day, it is not only necessary to practise deep breathing, but they will probably require, in addition to the walk mentioned, half-an-hour's arm exercise with dumb-bells, so as to expand the chest and cause deep inspiration. This should always be done with free access of fresh air.

The exercise to be taken will, thus, vary with the occupation, and common sense will have to be exercised in determining the best method of supplementing the daily work.

6. *Dangers of tubercular infection.*—By far the greatest danger of contracting consumption arises from being much in the company of phthisical persons, or from frequenting places to which they resort. It is, however, not necessary to avoid them. All that is needed is that certain precautions should be observed. The expectorations of persons afflicted with consumption, or who suffer from a chronic cough or spit, should never be allowed to become dry, as the dust to

which they give rise is highly infectious. They should, therefore, be received into a spit cup or spit bottle, and the contents be poured into a water-closet or drain, while the spit cup or spit bottle should be carefully washed once a day with scalding water.

After the use of the spit cup or bottle the mouth should be wiped with a clean rag or piece of soft paper, which should be burned or set aside to be burned. Persons subject to fits of coughing should be careful not to cough violently in the neighbourhood of others, as it is believed that matters so coughed out may directly convey the disease. They should not use pocket-handkerchiefs to spit in, and if obliged to use them on account of fits of coughing they should be careful to take them quietly out of their pockets, and to disinfect them with scalding water at the earliest opportunity.

If these precautions are rigidly observed there should be no danger of infection. But, though these rules may be carried out at home, workmen, at all events, have no control over their fellows at work or in other public places. All that they can do at present is to discourage the dangerous habit of spitting in the workshop, by calling attention to it and insisting on its cessation, until the legislature has come to their assistance.

Particularly dangerous places to persons of a weak constitution are the smoking-carriages in railways, public houses, and clubs.

7. When any person has reason to suspect that he is beginning to suffer from phthisis, he should at once get medical advice. If there is any corroboration of his suspicion, he should at once adopt the above precautions, both for the sake of others, and to aid his own recovery. It is dangerous for a consumptive to inhale the dust from tuberculous expectorations, as it may set up fresh centres of disease, and so prevent his lungs from healing. Recovery from consumption is not at all uncommon, and anyone may expect to get better who takes the disease early enough, and carefully follows the doctor's instructions, including the necessary measures of precaution above mentioned. Early signs of consumption are failing strength, quick pulse, raised temperature, loss of sleep, night sweats, and perhaps, quickened breathing and pains in the chest.

8. Strong people do not readily take consumption, though if exposed to infection in a very intense form, as when living at home with a consumptive who does not take sufficient precautions, or when breathing the atmosphere of many workshops, public houses, railway compartments and so forth, in which spitting is freely practised, they are liable to, and do contract the disease.

Those who easily contract the disease are persons who—

(*a*) Have thin chests or a poor constitution.

(*b*) Those who take much drink, and so have impaired their digestions and injured their lungs.

(*c*) Persons who have sustained a severe shock or injury.

(*d*) Those who have recently suffered from inflammation of the lungs or bronchitis, from typhoid fever, from kidney disease, or indeed from any grave and weakening illness.

All such should not be allowed to return to work until they have become strong again, and should carefully avoid the company of consumptives, and places in which spitting is practised.

(*e*) Severe mental distress predisposes to consumption.

(*f*) Above all, insufficiency of food is a most potent factor.

It may seem useless to mention the last two factors, but thoughtful people will see many ways in which to alleviate both one and the other.

9. We may thus summarise the advice given above:—

Take pains to keep yourself as healthy as possible.

Spend your money on food, clothes, and the higher pleasures rather than on alcohol.

Use your influence resolutely in exacting necessary precautions as regards the disposal of their expectorations by those people afflicted with a chronic cough, when you can in any way control.

If unfortunately affected yourself at once seek medical advice, keep your courage up and hope for the best, while carrying out strictly all necessary precautions.

[*This discussion applies also to the papers by* Dr. Arthur Newsholme *and* Dr. Henry R. Kenwood and Dr. Gerard C. Taylor.]

Dr. Cooper Pattin (Norwich) said he believed in compulsory notification, and had advocated for years its application not only to phthisis but to all forms of tuberculous disease, and that he submitted was the scientific method of dealing with the problems they had before them. At the same time no one was more conscious than himself of the great value of the practical work which Dr. Newsholme and Dr. Niven had done with voluntary notification. It seemed to him, however, to be rather a mistake to speak of the cure of phthisis and the curative treatment. What they really got in the sanatoria was recuperative treatment, for if there was real destruction of lung tissue it was impossible that it could be cured. There must remain "scar tissue," and therefore the lungs could not be put in the position that they were in before the illness occurred; but they could get recuperative treatment and a practical recovery of health. He was interested to hear Dr. Kenwood say that it was the insufficiency of voluntary notification which made in favour of compulsory notification in London, and he should say that it would be found that if they made the notification of the pulmonary type of tuberculosis compulsory, it would be the insufficiency of that type which would lead to the notification of all forms of tuberculous disease. In his district two out of five of the deaths from tuberculous disease were attributed to diseases which were not pulmonary at all. He wanted to see every form of tuberculous disease notified, and not simply the most obvious and most dangerous form which affected the lungs; and he suggested to the Medical Officers, at any rate in the Metropolis, that the time had come when they might bring all the pressure they could exert to bear upon the Legislature to have compulsory notification made obligatory in London. It might be necessary to accept compulsory notification of phthisis only as a practical measure at the moment, but he hoped that whatever steps they took in that direction they would take care to keep before the public (which was far more intelligent in these matters than they were apt to suppose) that it was the notification of all

forms of this disease that was their ideal. If they did not do that they would give the more intelligent members of the laity an impression that their methods were not scientific.

Dr. J. F. J. Sykes (St. Pancras) said they would all recollect the Congress on Tuberculosis in London, and would remember probably that at that Congress the great question raised was the establishment of sanatoria. These were very good things in their place, no doubt, but they were very far from solving the whole question of consumption. It was a curious fact, by contrast, that all the papers that had been read in that section that day had been dealing rather with the question of notification, and all pointed in the direction of compulsory notification; in fact, he felt that they were all agreed upon the necessity of compulsory notification as a first step, because they would then get to know what it was that they had to deal with. Unfortunately in this country we were accustomed in our legislative and administrative measures to groping blindly in the dark and putting the cart before the horse, though happily we sometimes arrive at correct conclusions. A comparison of continental methods was not to our advantage. Compulsory notification of phthisis would enable us to know with much greater precision what it was that we had to deal with; but there were two things which were already known through figures and experiment. One was that a main cause of the spread of phthisis was the sputum, and the other was that a want of cubic space was a predisposing cause. One was proved by experiment, and the other was proved by statistics. The death-rate from tuberculosis in this country had been gradually diminishing ever since 1865, and a remarkable fact was that the female death-rate was diminishing much more rapidly than the male death-rate. That fact pointed to one very important thing, it was the improvement of dwelling-places. All these years the improvement of dwellings had been going on, and the consequence was that the women were benefited more than the men. It was stated that in Germany there was no such movement, the death-rate of males and females being practically the same; and that when they introduced their very elaborate sanatorium system they found that the phthisis death-rate fell rapidly, a steep descent in the mortality showing that before that time they had not made efforts to indirectly affect the disease like those which had been made in England. It was evident at once that the two great things to do nowadays, assuming that they had compulsory notification, were, firstly, to stop spitting (and they ought to have a general law throughout the whole country forbidding spitting in covered places, inhabited rooms, railway stations, and so on) and, secondly, to increase the amount of cubic space in the homes of the poor. He was very strongly of opinion that this latter would be absolutely essential. Figures proved that it had been of enormous benefit in the past, and it was bound to prove to be even of greater benefit in the future. New York statistics showed clearly that it was this crowding that was still perpetuating tuberculosis in New York, where they

had a most elaborate system of dealing with it. The next point would be the improvement of clothing and food, and this as they knew was going on very rapidly. The population was getting better clothed and better fed, and those who were not so well clothed or fed they must leave to the philanthropists. Then the next matter of importance was the early diagnosis of disease. Unfortunately at present the disease was caught in the middle stages and not in the initial stages. There were far too many of the cases which were only discovered when in the middle stage. Bacterial examination was an important point. Then came the question of the sanatorium. That was the remedy for the middle stage of the disease. Those who went to the sanatorium were those who had the disease well established. Then came the final stage, when the patient was hopelessly ill and unable to be otherwise dealt with. In the final stage the persons to deal with the disease amongst the poor were the Guardians. It was quite clear that Poor Law Guardians should institute sanatoria. There had been strong advocacy for the sanatoria *treatment* of consumption, but now the advocacy was for sanatorium *education*. Could they call it sanatorium *treatment* of consumption to put a patient into a sanatorium for a month in order to *educate* him? Surely the education could be as well done elsewhere as in the sanatorium. Then the sanatorium treatment in the middle stage sank into a secondary place in the treatment of the disease. He was very pleased to see that there was a current of popular feeling going through the country that spitting ought to be prohibited, and he felt sure that what would conduce more than anything else to preventive measures would be the compulsory notification of phthisis, because the Medical Officer would then discover and come into contact with the people concerned, and when they learnt the effects of overcrowding and spitting, people would readily realise that these matters needed to be dealt with in a more stringent way.

Dr. W. G. Willoughby (Eastbourne) said he had recently had an opportunity of seeing Dr. Newsholme's experiment at Brighton, of taking consumptive patients into blocks at his ordinary sanatorium, more for the purpose of giving them a proper education as to what they should do than with the idea of permanent cure, and he could assure the meeting the experiment was a great success. In future years he would have had most of the poorer people in his district who were consumptive through his sanatorium in batches, and they would all know what to do to prevent the spread of the disease to their families and their fellow working men and women. Dr. Newsholme selected his cases as far as possible at present from men and women who were actually at work in families and workshops where there were a great many others, and it was likely that they would carry their knowledge to others. With all due respect to Dr. Sykes he did not think it was possible to teach the patients in a similar way at home, because there they would be free to please themselves about following instructions, whereas at the sanatorium they had to do practically what they

were told. They were compelled to use spittoons and paper handkerchiefs, and to have open windows there, and with any amount of education at home nobody could be sure they would do these things; but if they had been in the sanatorium for a month or so and become habituated to all these precautions they would carry out in the home, when they went back, what they had been taught in the sanatorium. Dr. Newsholme's experiment was also a splendid practical protest against the unnecessary amount of money which had to be spent, now-a-days, in the building of the ordinary sanatorium for consumptives. In reference to Dr. Kenwood's paper, with all respect he submitted that the advanced cases and the poorest cases were the best they could have notified for preventive purposes. The advanced cases through their expectoration did most to cause the spread of consumption, and it was the poorer classes who were crowded together who most required to be taught what should be done. Dr. Willoughby himself had in Eastbourne a triple form for notification. He asked the medical practitioner when notifying to state (1) whether he wished no interference at all, (2) whether he would like the sanitary department to take any steps they thought fit for the patient, or (3) whether he would like the Medical Officer of Health to take steps in the case in consultation with him; and he found that the triple system worked very well, and should think that he got, perhaps, three tenths of the cases notified. He wanted to protest most strongly against the excessive expensiveness of sanatoria for consumptives in the present day.

The Rev. E. N. Mullins (Blackwell R.D.C.) said he thought he ought to let them know that there were some Boards of Guardians who had attempted to tackle this question. The Board with which he was connected were so impressed with the idea of sanatoria, that they temporarily put their phthisis patients into a verandah place. He had felt very doubtful whether people in the last stages of consumption could stand the exposure, but they appeared to be able to stand it, and enjoy it. This led the Board to a practical trial, and for a comparatively small sum of about £600, they added to the end of a hospital building a large iron verandah, something like a conservatory with no sides, and in suitable weather the beds of the patients were put out so that the patients could be in the open air, and there they were basking and improving. The results of the experiment were important for them, because theirs was a colliery district and they had a good deal of collier's phthisis. They found also that the action of the Guardians had an educational influence, and neighbouring farmers were improvising arrangements of a somewhat similar sort for the benefit of members of their family who were affected.

Dr. T. Fisher (Garstang) said he thought, speaking generally, they might assume that voluntary notification was a practical failure. Every speaker that morning had admitted that a very large proportion of cases were not notified at

all, and therefore were not under direct control, and were a focus of further infection. It would seem that compulsory notification was the fundamental principle for combating this terrible disease. In his rural district they had adopted voluntary notification, and he was prepared to say that it was a practical failure so far. People might ask what good notification of phthisis was in a rural district, but he ventured to say that it was of the utmost possible importance. He had advocated in rural districts what he might call a novel treatment. There was in many rural districts a very steady going population, and, taking it as a rule, the Rural District Councils or Boards of Guardians were a very difficult set of men to move. He had himself suggested, however, that in localised cases of phthisis they should adopt a sort of tent system. It was an easy matter to tack on to a farm or cottage dwelling a moveable tent and have it so arranged that it could be placed in the most elevated and sunlit spot, with moveable sides to be opened in the direction of sunlight and fresh air. This was an important adjunct to the treatment of this terrible disease in rural districts. In reference to the important question of early diagnosis, it seemed to him that in order to get that they would have to send off the expectoration to some bacteriologist. His Rural District Council had adopted a free arrangement for all medical men in his district who would send the expectoration voluntarily to a bacteriologist and get a report. That was an important matter, because very often before the stethoscope gave them reliable signs they could get definite information from the expectoration and thus be able to tackle the disease at an early stage. Another knotty question was that of milk. It was important that they should have as soon as possible the report of the Royal Commission on tuberculosis on the question of milk, and the difference between the two bacilli which Dr. Sykes alluded to at the Tuberculosis Commission; whether these two were the same in cows and in man. They wanted to know whether milk coming from a tuberculous cow was still capable of producing tuberculosis in the human system. This question affected them greatly in the rural districts because there was no sterilisation there, and the milk was taken directly from the cow and consumed, and everywhere at the present moment, as they must admit, the early diagnosis of tuberculosis in the cow was extremely difficult. They would like these questions thrashed out at the earliest moment. Then there was the social question. There was no doubt that the social question was a very important one, but it seemed to him that the public at large, both the intellectual and the poor, were beginning to grasp the significance of it. They could hardly go into a cottage dwelling in the country districts nowadays where if the word consumption was mentioned it did not strike fear throughout the whole of the household, and the people would all take the utmost possible care to keep down the infection; and so they had in the individuals themselves the conditions arising to prevent the spread of this terrible disease. So far as individual people were concerned, he thought they must adhere to that course of action. He was pleased to hear that the last speaker had a triple form of notification,

involving the consulting of the individual or individuals at the infected dwelling. Every intellectual person at the present day had fully grasped the dangers of tuberculosis, and what they had now to do to a very great extent was to tackle the poorer people and give them information on the subject. It was amongst the poorer classes that tuberculosis had its most terrible effects, because there they had over-crowding and poor light, and insufficient ventilation and too little cubic space, which were all suitable conditions for the growth of the disease. He should like to endorse the statement that the guardians of the poor were the people to take this matter in hand. In his last annual report to his Council, he offered to go and visit some of the sanatoria and bring forward certain ideas, but he agreed with the previous speakers that it was entirely prohibitive to put up such expensive buildings; and he should like to see common-sense principles exercised in relation to this matter in both rural and urban districts, but particularly in rural districts where they had the opportunity of getting fresh air and ventilation, and of making sanatoria at home.

Dr. Alfred Hill (Birmingham) said that in Birmingham they had no notification, either voluntary or compulsory, but he had distributed broadcast bills advising people how to proceed in cases of phthisis. They had also had three women health visitors, and kept a record of all the cases of phthisis which were discovered, and these cases were visited every month by the women, who went to see whether the people concerned were carrying out instructions. They believed that this work was exceedingly valuable, and that the women health visitors were, perhaps, the most important factors in the community for protecting and raising the condition of the health of the lowest classes. An attempt had been made to induce the Guardians in Birmingham to provide a sanatorium, but it did not succeed; the expense, no doubt, stood in the way. He had not heard previously of the method recommended by Dr. Newsholme to give a month's instruction in the sanatorium, and that seemed to him to be most valuable. Under the old circumstances the expense of sanatoria was decidedly prohibitive, and made the provision of them utterly impossible in many places. This scheme of Dr. Newsholme's seemed to him to hit the right nail on the head. Certainly they could not thoroughly teach the people to observe the rules of hygiene in their own homes, but if they took them into better surroundings than their own wretched houses and taught them methods of better protection and control, and habituated them for a time to a proper mode of procedure and then returned them to their homes, it would do much to educate them and ameliorate their condition.

Dr. A. K. Chalmers (Glasgow) said it was good that the meeting had emphasised as it had done the means of minimising the cost of sanatoria, because this was becoming quite prohibitive and entered very largely into the question whether or not such institutions could be provided. For some time past it had

seemed quite apparent that the value of sanatorium treatment depended largely upon its educative influence on the individual; on the fact that by its means they might prepare a man in such a way that he might become, so to speak, an apostle of the sanatorium methods of managing his life. After spending from four to six weeks under an entirely new method of living he might be sent back to his own district to put into practice in his own household and among his neighbours what he had been taught, and show the essential value and practicability of the sanatorium method of treatment in his own home. If this discussion did nothing more than emphasise the fact that it was the education of the consumptive in a new and better method of life that was needed, something very useful would have been accomplished by it. There was one element, however, which he thought did not enter so largely into their discussion of the value of sanatoria as it might do, and that related to the question what they were to do with the people who left sanatoria benefited by the treatment there, but who, under the present lack of any system for circulating information regarding employment suitable for consumptives in this country, must return to the conditions of their home life and of the working life under which they existed before their education in the sanatorium was begun. It appeared to him that some such system of notification was necessary, and sanatorium treatment, if it was to become really effective, must have bracketed with it a national bureau of information, whereby districts would be able to obtain from each other information regarding the possibility of obtaining work which would suit the individual after he had gone through his course of education. In reference to the effect of a personal proximity on the spread of consumption they found in Glasgow that in the one-roomed dwellings phthisis was much more prevalent than in houses of larger size.

Mr. Robert Lambie (Lanarkshire C.C.) said it seemed to him that a cause of the spread of the disease was the construction of dwellings. In Lanarkshire they had appointed a committee to investigate the matter because consumption was terribly prevalent. If they were to turn their attention to the improvement of the dwellings, and better ventilation and more fresh air, he thought they would be doing something to stem the terrible ravages of the disease. He did not think they should tinker any longer with voluntary notification. If they believed the evidence which had been given there that day, why should they not demand that phthisis should be notified like any other infectious disease and dealt with from that standpoint? Then, having compelled notification, they should provide for the treatment of patients in buildings which should be of such a construction that, whether they were rich or poor people, they should be comfortable. If the disease was to be dealt with satisfactorily it should be dealt with from that standpoint, and they as a conference should make their position clear and not be sitting on the fence. They might have to stand abuse, but their action would ultimately be for the benefit of the community. In

regard to the one roomed dwellings in Scotland, he should like them to tell him how a man was going to pay for more than one room who was getting a pound a week and had four or five children and a wife to keep. He would like to see the ladies and gentlemen comprising that conference attempt to handle the money in such a way that they could have more than one room to live in. The first necessity for the prevention of consumption was fresh air, and therefore they should insist on having dwellings erected on a different system so that they could have plenty of fresh air.

Mr. Arthur Weekes (Hurstpierpoint) said he represented a sanitary authority which had adopted voluntary notification, and he had attended many congress meetings and had always seen that the majority was against compulsory notification. He wanted to know how those who were in favour of compulsory notification would face a difficulty which presented itself to his mind. If they had phthisis notified compulsorily as an infectious disease, were they prepared to make it compulsory for persons who had got the disease to enter an infectious hospital? In such a case the difficulty was that the ordinary infectious hospitals would not do, and they must remember also that consumption was not a disease to be cured very quickly. Possibly it might do for patients to be sent to an ordinary infectious disease hospital if they had separate wards for consumption, but the patients would be there for a long time, and he would like to know for how long a time it was proposed to keep the patients.

Dr. W. Butler (Willesden) said one feature which had marked this discussion was that the methods of dealing with consumption were preventive in the wider sense of the term. Sanatorium treatment had been of the nature of education, and the trend of the preventive measures for dealing with consumption of late had been in the direction of educating the patient as to what he should do and what means he should take to prevent himself from becoming a danger to others. He thought Dr. Sykes had indicated one of the most important of these measures. They should deal with phthisis in a general way in the improvement of the hygiene of the home, and the abolition of the small room where consumption was bound to spread. He thought, perhaps, there had been a tendency to deal too particularly with consumption. He was not sure that if they had universal notification of phthisis, and devoted all their energies to dealing with that as a specific disease, that they would not do the public health rather a harm than a benefit in the end. They might benefit the consumptives, but he was not sure that they would be benefiting the public health. As the President had pointed out elsewhere, consumption was a selective disease which preyed upon those who were the least desirable physically of the population. It had a special incidence upon the insane and those with a proneness to nervous diseases and so on, and if they selected consumption and directed against it preventive measures conceived exclusively in the interest of a type

especially susceptible to its infection, and that without regard to a general raising of the standard of living, he feared that they might do harm by protecting a type for whom it was undesirable to legislate specially. He thought it was better that the trend of their attempts should be rather on general lines than upon exclusively particular lines. Legitimate particular measures would be not to isolate the consumptive strictly from the community, but to instruct him so that he, whilst still among the general population, should cease to be a danger, and to maintain the sanatoria, not of places for permanent isolation which would be prohibitive because of the cost—but to look upon it as means of education where the special precautions to be taken in the interest both of patient and public could be taught. There was one aspect of the sanatorium which had not been touched upon and which deserved consideration. It was in the late stages of consumption that it was necessary that the consumptive should be isolated. Dr. Koch had pointed out that in the late stages it was most virulent as an infective disease, and that the ordinary means of prevention were useless. At this time they had not merely to deal with sputum. Every word that the patient spoke and every breath that he breathed was associated with the dissemination of tuberculous bacilli, and then, whatever instruction had been given to the patient in the sanatorium, they could not prevent him from being a serious danger to all about him. They would recognise, therefore, that consumption must be variously dealt with in its different stages. In the early stages what was wanted was education, and in the late stages isolation was needed; and at all events, throughout they should aim at raising the general standard of hygiene, because it was in the low standard of hygiene, and in the overcrowding and bad sanitation of the slums, that they had essentially the conditions of the production and spread of the disease.

BAILIE W. F. ANDERSON (Glasgow) said he was one of those who, when the experts had decided upon a particular course in the treatment of this or any other disease, was in the unfortunate position of being the person who had to go and face the public and ask for the necessary money. Of course, if there was any mistake made it was not the expert who was blamed, but the person who asked for the money. Therefore, whilst he was entirely sympathetic, he wished to speak a few practical words to the doctors who were present. The doctors could do a great deal in the way of combating such things as consumption without exerting themselves very much. In Glasgow they had a bacteriological department in which they provided the medical faculty, free of charge, with all the necessaries for submitting their samples of sputum to the bacteriologist. That had been in existence for three years, and during the three years the number of medical men who had taken advantage of this department had only risen from something like 240 to 360 out of practically over 2,000 medical practitioners in Glasgow. He did not think their medical men were wise in thus neglecting the opportunity which was offered to them by a public authority

who had taken the trouble to establish a bacteriological department. It was all very well for the medical men to preach to the public authorities as to what their duties were, but the medical men, on their part, had a perfect right to turn round and say that they wanted an ounce of practice occasionally. He looked upon consumption very much as he looked upon a fire; and thought that if they would only take the sputum and satisfy themselves that the bacteria were there, and then at once inform the patient and from that moment take the necessary steps, it would help very much in preventing the spread of the disease. It was all very well to provide retreats for the hopeless, but he wished to do something for those who had not got to that state. In Glasgow the authorities had equipped a very fine sanatorium for the paupers, but he wished also to have sanatoria for the benefit of the working men who did not want to become paupers, but needed and desired three or four months rest. They had bought an estate of thirty acres and had got an administrative block, and all they wanted now was the necessary money—£400 a bed—and they could practically find 2,000 people in Glasgow to-morrow who ought to go to such a sanatorium. But 2,000 people at £400 a bed meant an expenditure of £800,000. Where was the public man who could ask for it? What they had done in Glasgow was they had established a branch of the National Association for the Prevention of Tuberculosis; and they wanted the medical men at this Congress to endeavour to stir up the local authorities elsewhere to a similar kind of effort to catch the disease in its initial stages. If they would do that, and would take full advantage of the means which were already placed at their disposal by the public authorities, it would enable people like himself to go forward to the local authorities, who were often more careful about the rates than they were about health, and say that, as the means provided were being taken advantage of (and human life was not to be measured by money), they insisted upon the means to enable them to take the proper steps. They had notification from all the dispensaries now, but what was the good of notification if it simply ended there? They had, however, appointed an assistant to Dr. Chalmers to do nothing else but follow up all the cases notified from the dispensaries. He did not agree with Mr. Lambie, because he did not at all see the necessity (if people were able to educate in their own homes members of the family of a consumptive so as to keep them free from infection, and practically to isolate the consumptive) why they should be a burden upon the rates, and make it more difficult for the authorities to protect those who could not protect themselves. But whilst he was not prepared to go the length to which Mr. Lambie went, he did think that the natural sequence of notification was that they must provide hospital accommodation for those who were notified.

Mrs. Cliff Scatherd (Morley Hall) said there was much work for educated sympathetic women to do amongst the congested parts of our great towns. How was it that patent medicines and foods were so largely used? Simply because

an agent went round and said a few explanatory persuasive words as to their merits, and directions for use were printed on every packet sold. Let this Conference take a leaf out of the agent's book and show people why they should eat whole meal brown bread and fresh green vegetables; how to make tea and never to boil milk. They are ready to do these things when their great use is explained. Her husband had for long years past employed such a woman missionary in their hilly town. She found the people willing to notify infectious diseases if explanation as to germs was given; convince them by good reasons and compulsion was not needed in most cases. It was hated, and its tyranny in various forms was surely destroying that freedom which had always been our national boast.

The President (Prof. Clifford Allbutt) agreed that it might be better to do without compulsory notification, but his impression was that compulsion was an ill-sounding word, and that it would be far better to call it systematic notification than compulsory notification. He believed that in practice there would be little or no compulsion. He had never come across anyone, whether in the wage-earning or middle or upper classes, who had raised any serious objection to the notification, certainly not among those members of society who enjoyed the larger education, and little even among those who had had less educational opportunities and advantages. His experience was, and from what he had heard from medical officers generally their experience was similar, that objections to voluntary notification were unknown. He did not think that even any individual objection was experienced. It had been well said by one of the speakers that in the matter of consumption and tuberculosis generally education in medical truth had come very much more rapidly to the people than had usually been the case in such difficult matters. It had sometimes been difficult, for example, to get people to see the connection between filth in general and typhoid fever. That had been a long and very arduous fight, and the battle was not entirely won yet. But consumption for some reason or other (perhaps the successful discovery of the bacillus, its prevalence in the cow byre, its dispersing in milk and butter, and the way in which it struck some of the fairest, strongest and best of the population) had taken hold of the public mind. He objected to the assertion that phthisis merely struck down the weaklings. It was just as apt to strike down the handsomest and strongest. It was so far indiscriminate. At his time of life he had to look back upon people whom he had considered to be physically some of the strongest and best of the race, who had been struck down in this apparently indiscriminate way. This was so evident, and had so affected public opinion, that people were now prepared to go a very long way, much further than usual, with measures for prevention. Dr. Sykes and other speakers had pointed out that at present they could not obtain systematised materials, but were blundering on in rule of thumb fashion. When systematic notification was got they would be able to chart out on their maps

where the tuberculosis was and how it spread. If they could only get charts before them they would discover a great deal about the way in which it dispersed itself in the community, and of course, such information is of little use unless it is systematic. In regard to cheap sanatoria he had long been an earnest advocate of these, and he was quite sure that, with the exception of a few large pattern places like the King's sanatorium, to make the sanatoria generally so expensive had been an error and had stopped a great deal which might have been done. In the Cambridge hospital they had two long open colonades divided into four; and to fit these corridors up for about seven or eight patients each had only cost about £50 apiece. This cost of £200 had been provided by private persons, and for this sum they were enabled to get 30 beds in these corridors. It would astonish them to see the patients sticking to the corridors even in south-west storms, they would even be drenched with rain rather than go inside. In regard to advanced cases he thought it would be a very sad thing to have refuges put up for incurables affected with this or any other disease; and he could not understand why public authorities should not take, in the midst of crowded neighbourhoods, three or four cottages where they would receive advanced cases. Naturally these poor people dread and dislike being carried away from the midst of their friends; and of course it is an afflicting idea to be carted off as an incurable. But if cottages were taken with three or four beds in each cottage, and a fairly well instructed matron nurse was got who could be relied upon to carry out certain simple rules, patients would be more at home in such cottages, and would no longer be centres of infection. The cost would be next to nothing, and it would be a great comfort to many an overburdened household if the patient were removed not far away, but kept among his own people. One speaker had touched upon the question of milk, and he had felt that that speaker was wondering whether he (the President) knew anything about the findings of the Royal Commission in which the University of Cambridge was largely concerned. He thought he could say this much, from what he had heard from his Cambridge colleagues, that they would have very substantial information to give when their researches were ripe for publication. They were just beginning now to come to a judgment on experiments which had been going on for a couple of years, and these results promise to be substantial. When he lived in the North he was a bit of a farmer, and was led to notice a disgusting practice which he saw had just lately been mentioned in print, and bears upon the question, "Does all the tuberculosis which is found in milk come from the cow?" It was a practice of the milkers (he believed a very wide-spread practice) to spit upon their hands before they milked a cow. Moreover, a person in the earlier stages of phthisis was a person who could very well be spared from the rougher labour of the fields and was very likely to be put on as a milker. Whatever be the danger of bovine tubercle, this dirty trick opened the door to infection by the human form of bacillus through milk. Their object ought to be not only to prevent the men spitting about the mistals, but also to

have means close at hand by which the men could wash their hands before they milked. He had always provided such means in his own mistal, but would be sorry to assert that they were scrupulously used.

Dr. J. F. J. Sykes (St. Pancras) moved the following resolution: "That this section of the Congress is of opinion that the time has arrived for a systematic notification of consumption, and recommends the Council of The Sanitary Institute to act upon this opinion." He said this would record the opinion of the section, and it would be extremely valuable to get on record what the opinion was of those of them who had been thinking about this subject, and to show what advance public opinion had made in the course of the last few years since the time of the Congress on tuberculosis.

Dr. Kenwood said he should be very glad to second the resolution.

Notice was given of the Resolution for the meeting of the Section on the following day, when it was formally carried.

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council upon any resolution are published in the page preceding the Law Reports.

THE NOTIFICATION OF THE NON-NOTIFIABLE DISEASES.

By EDMUND MOODY SMITH, M.D., C.M.Edin., D.P.H.Camb.,

Medical Officer of Health for the City of York.

(MEMBER).

THE Notification Act of 1899 was incomplete in that it did not extend the Act of 1889 to the diseases measles, whooping-cough, chicken-pox, German measles, and even mumps, which are surely as infectious, as properly notifiable and of as much importance to the community at large as erysipelas, continued fever and relapsing fever.

Notification by school attendance officers or by teachers is insufficient; but it is useful and I would not abandon it; but the Act should be extended so as to include these diseases, and the householder should be made to realise his responsibility and duty under the Act. It is the householder, parent, or guardian upon whom the responsibility of notification should fall, not upon teachers or school attendance officers. Make his responsibility and duty fully known by newspaper advertisement and handbill, and I think that he will soon realise it and carry it out. I am the more persuaded of this by my recent experience of chicken-pox notification; 152 notifications were received during six months, 149 of which were by medical practitioners, and the majority of the cases were amongst the working classes.

No doubt, if the householder call in a doctor to diagnose, he will leave notification entirely to the doctor. But most householders are afraid to disobey the law, if they know it, and many have a strong sense of public duty, so that notification by the householder where a doctor has not been called in is practicable, and so is dual notification *if properly managed.*

At present, the householder knows that scarlet fever is notifiable, and

measles are not; he therefore regards measles either as non-infectious, or as very much less important:—it is "only measles," and of no account to the public health. Moreover, the householder can pass over all his scarlatina cases as "only measles," which don't cost him any bother.

The present position is therefore inconsistent. Some say that notification is of no use, and does not reduce the prevalence of, say, measles. But I say that you cannot properly compare experience before and after notification. Take a period before notification in which you hear of, say, 500 cases of measles. You afterwards adopt the system of compulsory notification of measles, and in a subsequent epidemic three or four years later you have 500 or 600 notifications. You cannot properly say that notification has done no good in reducing prevalence, for without notification and consequent measures you might have had as many as 1,000 or 2,000 cases in your second epidemic.

It is said that notification of measles won't work. I don't believe it. The fact is that the system has not been sufficiently made known to the householder. If chicken-pox notification can be so successfully worked, why not measles notification?

The Local Government Board should be urged to extend compulsory notification to measles, &c., for the following reasons also:—

1. For statistical purposes—calculation of case-mortality, &c., is at present impossible.

2. For educational purposes. In itself notification is an educational medium; thereby people are made to realise that these diseases are infectious. At present many do not know that chicken-pox even is infectious; they regard prevalence as an accident, and do not associate it with personal contagion. Educate them whilst the iron is hot, send a leaflet whilst the disease is in the house; they will better understand the leaflet when they have an object lesson in the home, and will remember it better in consequence. Let the leaflets be in the simple home language of the poorest people, not specimens of florid English.

3. For prevention, as far as possible, by insisting upon isolation, regulation of school attendance, &c.

During a period of chicken-pox notification we have been able systematically to exclude all affected children from school and to secure such disinfection as was necessary.

Further, why notify measles? (*a*) Because scarlet fever is passed over by householders as "only measles." This happens over and over again, owing to measles not being notifiable. (*b*) In order to know the progress of an epidemic—and when to re-open a closed school.

As to mumps; I have known scarlet fever and diphtheria both passed over as mumps, and mischief follow in consequence.

Why notify whooping cough? In order to promote isolation of cases, and education about this fatal disease.

I need scarcely ask, why notify chicken-pox?

Why notify German measles (Rötheln, Rubeola)? Because it is so often confused with scarlet fever (it is often very difficult to diagnose), and it is *very* infectious. Some of the text books say that the difficulty is to diagnose it from morbilli (common measles). But in my experience this is a totally wrong statement. There is no such difficulty in the diagnosis from morbilli as from scarlatina. Sometimes the throat of Rötheln is quite as bad as the throat of a mild scarlatina.

Medical Officers of Schools.—The Medical Officers of elementary schools, so far as they have been instituted, have done excellent work, but the system is incomplete and requires greater development. One such medical officer is not sufficient in a large town. A medical officer of health is not sufficient; he is overloaded already. Inspectors of nuisances are not sufficient to follow up diagnosis of suspects; they are not medical diagnosticians. Diagnosis is purely a medical matter. An improved system, in my opinion, would be to employ general practitioners for small groups of schools or even for one single large school. They should be employed as special assistants to the medical officer of health at small stipends, plus usual fees for cases notified to him. They would visit their school or schools once a week or more, exclude cases and suspects, notify cases to the medical officer of health, visit suspects at home until the diagnosis is cleared up (unless the patient's own doctor was in attendance), advise the medical officer of health *re* school closure and re-opening; and exclude cases of ringworm, scabies, impetigo contagiosa, &c., by order upon head teachers.

I am not proposing compulsory notification of ringworm, &c., to the medical officer of health, as that would be unnecessary. But it is a shame to see the clean children of respectable, careful parents attending our board and other elementary schools infected by the neglected parasitical affections of less-cared-for children. And I would propose that medical officers of schools should have power to exclude these cases from school attendance, until cured, by order served upon the headmaster or headmistress.

It is not the province of this paper to refer to the work of medical officers of schools as to eyesight, teeth, &c. My purpose and anxiety is this:—

The Notification Act, which has had a good trial, and has done great

work, is incomplete in constitution, insufficient in operation. What we require is the completion of our methods in the circumvention of infectious disease, by the completion of the compulsory notification system, and the more thorough organisation of the system of medical officers of schools.

Dr. J. F. J. Sykes (St. Pancras) said he rather regretted that Dr. Smith had taken all the non-notifiable diseases in a bunch. He had a very strong opinion that the proper way to deal with this question of infectious diseases was to deal with each disease upon its own merits. Taking Dr. Smith's list of non-notifiable diseases, it was quite evident that they could not deal with them all in the same manner, and it was extremely difficult to deal with them all at the same time. To illustrate the differences: whilst ringworm was a disease which never killed, measles was a disease which often killed. Measles was a disease which had been made notifiable in a great many places, and it had been a failure everywhere, without exception. He could mention a dozen places where it had been a failure. He took it that Dr. Smith had got hold of quite the right idea in regard to notification of these minor infectious diseases. He had thought that it might protect the schools, and a very excellent idea it was; but the notification did not, as a matter of fact, effect the protection of schools. A measles outbreak was nearly always found when it was too late, and the school was closed and there was an end to the epidemic, but the epidemic had then done its work, and in instances where the school had been left open the result had not been any worse. It failed just at the very point at which it was wanted. With regard to whooping-cough the failure was still greater, because it was extremely difficult to say when the whooping-cough began and when it left off, and if a medical man was not in attendance there were many people who did not know what whooping-cough was. In mumps they had an epidemic before they knew where they were, and it was extremely difficult to stop. With regard to the notification of chicken-pox he would strongly advocate that on quite different grounds. It had always been his theory that chicken-pox should be a notifiable disease. It had been so in Austria for many years, and the reason was this: that out of one hundred cases of pock eruption fifty cases, in a time when small-pox was prevalent, would be found to be chicken-pox and fifty cases small-pox. That was the experience that one had gained by the notification of chicken-pox. In the doubtful cases the chances of them being one or the other were about equal, and it required a second medical man, and very often a third and more, before it was possible to decide whether the case was one of modified small-pox or chicken-

pox. When small-pox was about, chicken-pox ought certainly to be made a notifiable disease. He had the pleasure of persuading his own authority to make it notifiable the first time that it was made notifiable in England, and he testified to the immense advantage derived from doing this, because they then found out some facts about chicken-pox which they did not know before. But notification of ringworm and scabies could be dealt with under the Cleansing of Persons Act. In London they cleansed people not only for non-notifiable infectious diseases, but also for vermin. They could cleanse the people and disinfect their clothing and send them home again and repeat the process as often as was necessary, and exclude the children from school attendance during the time. There was another point: if they were going to make these diseases notifiable it seemed to him that there was something very much more important which might be made notifiable, if notification was justifiable at all. Diarrhœa, sore throat, and cough were three symptoms which very often were the premonitory signs of an outbreak in the school. Diarrhœa was sometimes premonitory to typhoid, and they always had dropping sore throats before diphtheria outbreaks. Yet if they were going to make diarrhœa, sore throat, and cough notifiable diseases they reduced the whole thing to an absurdity, because the chances were that a very large percentage of the children would be more or less affected in this way from day to day. The only thing they could fall back upon was the medical officer of schools, and clearly that was the solution of the difficulty, that there should be attached to schools a medical officer who should be a referee for the teachers. He always felt that it was a cruel thing to throw upon the school teachers, whose knowledge of medicine at best was small, the responsibility of judging whether or not a child was fit to attend school. He or she ought to have the opportunity of sending to the medical officer who should decide that question, and a certificate should be sent in the usual form. Medical officers of schools should examine children from time to time, and make anthropometric examinations also. They could tell then whether the children were being underfed and underclothed. In his judgment the medical officer of schools was absolutely indispensable. In this connection it occurred to him that there was opportunity for the employment of medical officers of health under rather better conditions. In some districts the medical officers of health were only employed for part of their time—one or two hours a day—in their official work. If these medical officers of health could also be made medical officers of schools and workshops, the whole of their time would be employed on official duties. That would be decidedly advantageous. In some districts, where the medical officer's time was entirely employed with his present administrative work, he could not undertake these duties to schools and workshops, and there he would require assistance or additional help in some way; but in the other kind of districts to which he had referred there would be a splendid opportunity of employing the whole of one officer's time, and thus the disadvantages arising from his being in general practice would be obviated. The present arrangement put

a man into a very awkward position in relation to other medical men in the neighbourhood.

Miss Norris said she wished to make a suggestion in reference to the prevention of skin diseases. In the schools towels were often used for a whole week, without being changed, by an indefinite number of children, and possibly an incipient case was not noticed until it had been passed on to a great many children. The superintendence of the provision of towels, which must be a spreading agent in skin diseases, might well come within the scope of the medical officer's department.

Dr. E. M. Smith (York), replying on the discussion, said Dr. Sykes must have misunderstood him. He did not intend to suggest that ringworm and other things of that sort were to be notifiable to the medical officers of health, but only that the medical officer of schools should have power to exclude these children from school attendance until they were cured, by order upon the head master or head mistress of the school. He knew that in many places notification of measles had been found to be a failure, or to be so costly that the benefit derived had not been commensurate therewith; but he had never yet been convinced by any of the papers which recorded its being a failure that everything had been done that was possible to make it a success, and he had never yet been convinced that the householder was sufficiently made to understand and realise his responsibility under the Notification Act. What he held was that if they issued a leaflet to the householder, describing the chief symptoms of the disease and pointing out his legal liabilities in regard to the disease, they would find that the householder would call in a doctor when there was a case of suspicious illness in his household. It was quite right that they should deal with these diseases separately. They already dealt with diseases under the Notification Act very differently according to their nature. Whooping-cough he would have notifiable chiefly for educational purposes, and in order to be able to exclude it from school attendance as soon as they knew it was whooping-cough, and thereby limit the spread of that disease in the schools. Another point in regard to measles was that scarlet fever was so often passed over as being "only measles," and he was quite sure, from his own experience, that it was not uncommon for a mother, upon finding a rash upon her child, to say that it was "only measles," knowing quite well that it would not be reported, and that she escaped all legal responsibility because it was "only measles." There were large numbers of cases of scarlet fever passed over and overlooked as measles, which thus escaped the knowledge of medical men, and caused the continued prevalence of this miserable disease, which, like the poor, seemed to be always with them.

The President (Prof. T. Clifford Allbutt) said he should like to take this public occasion of re-enforcing the proposal of notification of chicken-pox. At

this moment in Cambridge a disease was prevalent of which the eruptive element was that of chicken-pox. Two or three, nay half-a-dozen, physicians had been called in, and an emissary of the Local Government Board itself, and there still remained an exceedingly uncomfortable suspicion in the minds of those who had seen these cases that, although the spots individually presented the character of chicken-pox, their distribution and (at a later date) some prodromal rashes had unpleasant resemblances to small-pox, and the epidemic might turn out to be of the more serious nature. The symptoms, after some malaise on the day of onset, were trifling, even when the eruption was profuse. No ordinary small-pox existed in the borough, and the prevalent disease reproduced its own features in those who caught it. Without going so far as Dr. Smith had gone, it was true that the fact of certain diseases being non-notifiable led parents to regard them with a certain amount of indifference, and so gave rise to the idea that the children might as well get through these diseases whilst they were young, and so on. That abominable German measles was a particularly irritating puzzle, of which Dr. Cameron had told him an interesting story the other day. A gentleman was taken ill in one of the chief hotels in London, and it was suggested that he was suffering from scarlet fever. Being a man of great wealth he said he was not going to be removed, whatever the disease. He was told that if he was to stay in the hotel the whole of that floor would have to be cleared, and he replied that they must clear it. The hotel manager told him that the cost of doing so would run to thousands of pounds, and he replied that he did not care what it cost, but he was not going to be removed. There was tremendous excitement about the place and a wholesale clearance; but the next day the medical man on his visit said he had decided that the case was not scarlet fever at all, but German measles. He himself disliked being called to these cases. One was expected in an initial stage to give a final opinion at once, and it was often a most embarrassing position.

THE APPOINTMENT OF MINISTERS OF HEALTH.

By FRANK BUSHNELL, M.D.

Pathologist South Devon and East Cornwall Hospital, Plymouth; Hon. Secretary Devon and Cornwall Branch National Association for the Prevention of Consumption.

Authoritative Views on the Appointment.

A PRELIMINARY study of the subject has been made by myself and Miss C. Cochrane, M.San.Ins., by letters to various associations and bodies, and the British ambassadors and representatives and individuals abroad or in the colonies. My indebtedness is expressed to Sir John Simon's Work on English Sanitary Institutions (1877), and Dr. (afterwards Sir B. W.) Richardson's address to this Institute many years ago.

Among those who favour the appointment of a Minister of Public Health are the British, Canadian, and American Medical Associations, the Imperial Vaccination League, the Royal Institute of Public Health, the County Council of the West Riding of Yorkshire, the Manchester and Salford Sanitary Association, the Institute of Sanitary Engineers, the Workmen's National Housing Association, the Childhood Society, many eminent Medical Men of the various Countries, Members of Parliament, Medical Officers of Health, and Medical Societies.

This paper is not intended to deprecate any State Department, but is written with the desire to add to the powers and scope of those that exist, and to bring forcibly to your minds the need for national safeguards based on scientific preventive medicine proportionate to the growing needs of our densely populated lands. It is hoped to clearly demonstrate what to my mind is the primary measure best calculated to prevent disease with a consequent increase of the health, happiness, and wealth, of our fellow creatures.

The Value of a Leader.

The first query that comes to the lips is "Are there reasons for supposing that a Minister at the head of an independent Health Department would lead to an increase of the powers for preserving, and to an improvement in the health of the community?"

One may reply by reasoning from analogy. If one turns to the past annals of science and medicine statecraft, religion and commerce, and indeed any department of human activity, we have brought before us irresistibly the power of the *individual.* He leads the way; others follow in his footsteps.

To-day Lord Lister, Monsieur Pasteur, Kaiser Wilhelm, Mr. Joseph Chamberlain, Scientists, Emperor, and Statesman, possess the "divine right" of leadership. And so it has been since the days of the Messiah and Mahomet. One man can achieve in a year what takes most of us a lifetime.

The Abolition of Disease.

To illustrate the enormous value of widespread and organised measures, you have only to be reminded:—

That the Ministry of Public Health in Germany has practically abolished small-pox in that country;

That the Local Government Board has practically abolished rabies in England;

That Lord Lister has saved untold numbers of human lives by the practical application of bacteriological knowledge to surgical procedure;

And of the great reduction in the prevalence of plague, leprosy, and tuberculosis that has resulted from our national efforts in sanitation.

Such reminiscences indicate the possibilities of scientific sanitary measures. Past experience tends to show that the medical knowledge possessed by a Minister of Public Health, having proper status and exercising organising capabilities, would result in a steady diminution of the wastage of human life, largely by educating and guiding the public mind quietly and consistently in favour of health.

If these powers for good are once realised by nations, I am convinced that it is only the weightiest arguments (which to me appear to be absent) that could withstand the steady pressure of public opinion in favour of this appointment.

THE MINISTER AND THE HOSTILE FORCES OF DISEASE.

An enumeration of the hostile forces that would be arrayed against such a Minister is appalling; they exact such a toll as human foes, however relentless, would never impose.

A glance at the orderly array of "casualties," to use a simile, in the sixty-second report of the Registrar-General of the United Kingdom, for 1899, will satisfy anyone that this is true. Alcoholism caused the deaths of 2,871; cancer, or malignant disease, 26,325; tuberculous diseases, including phthisis, destroyed 60,659 lives; and the infant mortality was 163 per 1,000 under one year of age. 82,103 deaths occurred in lunatic and idiot asylums.

These are some of the diseases which undermine the constitution of the body corporate, and in the outskirts of the Empire malaria, cholera, and plague, must be added to the list. It is hoped that these figures will set men thinking, not of immediate relief or prevention, but of the unceasing and organised efforts which should be applied against disease from all points, if the art of citizen making is to be raised to its highest level. Fitness in brain, in health, in morals, in intelligence, in sound health, and will-power, can only thus be obtained.

FICTITIOUS ARGUMENTS AGAINST THE APPOINTMENT OF A MINISTER.

There are objections that arise in conservative minds to any alteration in the existing state of affairs. It is said that the appointment of another Minister would lessen the individual weight of those that exist. It is difficult to see how the removal of such specialised duties as the care of the public health from the already over-worked Head of a department would minimise the efficiency of other Ministers. Is it possible for one man, however brilliantly endowed, to have strength or time for the performance of such exhaustive duties as the superintendence and administration and promotion of agriculture, local government or what not, and in addition undertake the superintendence and charge of the health of millions? I think the answer is "No."

Again, it is said that the effective discharge of public health regulations must eventually devolve on local authorities. The truth of this I allow at once, but it does not weaken the plea for a Minister! In the future, local government will grow, in sanitary and other matters, it is sincerely hoped.

Over-centralisation is justly to be condemned, and the central authority that would attempt to *enforce unduly* even the wisest of rules on a community would not be tolerated.

But no greater spur to the proper sanitary progress of local authorities could be devised, nothing could be better calculated to promote the best interest of all departments than a trained chief with adequate powers. It is true that the fulfilment of our expectations would depend partly on the personality of the Minister, but in the long run our hopes would certainly be realised.

It was recently brought forward in the House of Commons, as an opposing argument to the appointment of a Minister, that we have more paid Ministers and a larger Cabinet than other countries, and I cannot criticise the accuracy of the statements.

At the same time, I cannot accept them as generally proving the inadvisability of further appointments. Indeed, our experience of the value of good government has created the posts referred to, and appears to me to favour the appointment I advocate.

The United States, Canada, and this country, as I have said, are moving in the direction of such a Minister, or such an Office as a Health Department, and I append such information as I have collected from British representatives as to sanitary administration in other countries. It is difficult to judge from the somewhat meagre sources at my disposal of the condition of these administrations, but they appear to resemble our own in their powers and resources.

Again, I am asked if existing arrangements are really insufficient in England. As I have said, I do not wish in any way to deprecate the efforts made with our existing powers, but I would reply with another question, the answer to which, I believe, states the case as it stands.

"Are the infectious, the preventable, the filth, and the industrial diseases or the infant mortality diminishing universally and in proportion to our knowledge of the potentiality for decrease?"

"Are investigations as to the causes and prevention of lunacy or cancer being duly promoted by state means?"

"Do the annual reports clearly set forth to the country the need for further measures of personal enquiry and direct medical supervision?"

"In fact, are State arrangements commensurate with the proper share of the efforts which should be made to prevent 'wastage' of life?"

Then the question of the increased taxation entailed by such an official and staff arises, and is apparently of great antagonistic weight. The

expenditure on our public departments is large indeed, but one cannot help being impressed with the fact that a country that can afford a grant of £15,300 to its Meteorological Office yearly, can afford to pay some thousands more for an improved public health service.

The Imperial Vaccination League recently made the remarkable statement that in London the recent epidemic of small-pox cost £500,000 in attempting to isolate sufferers. We may legitimately claim that this half-million of money might never have been expended with a Minister at the head of affairs with proper powers, and in any case it would have been better utilised in the support of an enlarged department of Preventive Medicine.

Dr. Farr calculated that the average value of a life for all ages was £150. This sum of £150 is too low an estimate of the value of each person restored to working capacity from disablement and death from phthisis.

In England deaths from phthisis amount to 60,000 per annum. Lower this mortality by 1 per cent. per annum only, as a minimum result of increased efficiency, and £90,000, or the cost of your department, is paid for by one small economic gain from the diminution of a single disease.

Further, pounds, shillings, and pence, are after all a fictitious estimate of an improved national or even individual standard of health. Lastly it has been said that nothing has been brought forward to prove that it is desirable to detach sanitary administration from other departments of Local Government. It must not be concluded that because a separate central office of health is established that local sanitary administration would therefore be disconnected from other local work. It is to be remarked, nevertheless, that a Local Sanitary Authority has a complete title or existence, such as are not to be found in the Central Sanitary Authority of the Empire, that speaking in a relative sense, Urban and Rural Sanitary Authorities possess more marked identity than the State Medical Department.

The appointment of a British Minister of Education has been coincident with the handing over of local administration of education to the local governing bodies, at a time therefore when correlation was taking the place of previous separation. No jot of evidence can be brought forward from this undoubted advance in education to prove that there should not be such a Minister!

I will not dwell upon the *modus operandi* of the proposed Minister, or suggest his attitude to local authorities; neither would I decry the value of voluntary effort.

I place before you briefly the existing basis in England on which a Ministry of Health would be properly laid, and an outline of its functions. The history of the Local Government Board should be studied in this respect, and is of great interest. It, and the intentions of the Sanitary Commission (1869—1871), throw a light upon the present arrangements which explains much that would be otherwise inexplicable. The powers and duties of the Board, too, are worthy of your attention, and the labours of its medical staff are beyond praise. Undoubtedly, the medical department of the Board and the General Register Office would form a basis for a Ministry of Health, but on these points I would ask for *free and full discussion and suggestion.*

I would also ask you to suggest the outlines of the duties of the Ministry, and its relations to the Home Office and Privy Council. I think it will be allowed that the Minister should hold a peculiar position of isolation from party and possibly of security of tenure of office.

Such suggestions as I have made are pieced together with a due sense of limitations and imperfections, and with every hope that the Congress' opinions will be fully expressed. If I can arrest the attention of this meeting on the central idea of the necessity for a Minister of Public Health presiding over a national sanitary organisation, I am well content. I leave the discussion of its practical and necessary details for the meeting, and for evolution in the future. The Director General of Public Health in Canada (at present an officer in the Department of *Agriculture*) has forwarded to me the following resolution passed by the Canadian Medical Association.

> "*Whereas*, public health, with all that is comprised within the term sanitary science, has acquired great prominence in all civilised countries, and
>
> "*Whereas*, enormously practical results have been secured to the community at large by the creation of health departments under governmental supervision and control, and
>
> "*Whereas*, greater authority and usefulness are given to health regulation suggestions when they emanate from an acknowledged Government Department;
>
> "*Therefore*, be it resolved that in the opinion of the Canadian Medical Association, now in session, the time is opportune for the Dominion Government to earnestly consider the expediency of creating a separate department of public health, under one of the existing ministers, so that regulations, suggestions, and

correspondence on such health matters as fall within the jurisdiction of the Federal Government may be issued with the authority of a Department of Public Health."

In reference to the efforts that are being made by the American Medical Association to obtain a Secretary of State for Public Health, the words of Professor William H. Welch, of John Hopkins University, are worthy of your attention: "I am in thorough sympathy with the movement to secure Ministers of Public Health."

In conclusion, I quote the words of one whom I venture to call the "Father" of English sanitary institutions, Sir John Simon, now in his 87th year:—

"One word I am tempted to add to emphasize what I hope is intimated in the volume (viz., 'English Sanitary Institutions,' chap. XV.) as to my very strong feeling on what should be the constitution of the central medical department. It is in my opinion quite essential that such a department should not be subordinate to any general secretariat, and that its report should be *direct* to the Minister, and should (when so intended by him) be laid as his reports before Parliament."

Dr. Herbert Jones (Hereford) said that when they began to discuss the question of the appointment of a Minister of Public Health it might be said at the outset that there was already such a minister in the President of the Local Government Board, and they should ask themselves how much better off they would be if they had the same minister under another name. It seemed to him that in all probability they would be no better off. He could not help thinking that with very little difficulty they could achieve one important reform which would go a long way towards remedying the disadvantages which now existed in the administration of the Public Health Acts, and that was for all public health officers to have fixity of tenure of their offices. It seemed to those of them who had not got that fixity of tenure that this insecurity lay at the root of nearly all their difficulties. It might not be so in large towns and in communities where a great deal of publicity was given to the doings of the sanitary authorities, but he could assure them that in rural districts and in the smaller towns it was the bane of all public health work. He knew of instances where a Medical Officer of Health had been re-elected year after year, and had settled down

to a feeling of certainty as to his re-election, but, on taking up his newspaper one morning, found to his amazement that the question of his re-election had been discussed at a recent meeting of his council, and that some other medical man had been elected. He had had no intimation that he was not likely to be re-elected, and simply found himself shelved in that way. If any public officer should be absolutely fixed in his office that surely was the public health officer, either the sanitary inspector or the medical officer. But he did not feel at all certain that they would be any better off with a Minister of Public Health.

Bailie W. F. Anderson (Glasgow) said he agreed with a great deal that was in Dr. Bushnell's paper, but from it he would argue to a very opposite conclusion from that of Dr. Bushnell. He thought that it would be the greatest misfortune that they could endure if they had a Minister of Public Health. The question had been raised in Scotland, and on the occasion of the discussion they could not get a representative medical officer of health from any part of Scotland to move a resolution in favour of such a minister. What was a minister? If sanitary officers and medical officers had the opportunity of electing a minister to preside over a Board of Health he would not feel any objection at all, but to say that the health administration of this country was to be nominally or actually controlled by a gentleman dignified by the title of Minister of Health chosen as Cabinet Ministers were was to inflict the greatest misfortune which could be inflicted on sanitation. The first thing they wanted as local authorities was to be let alone. They had had only too much proof of unnecessary interference by the Local Government Board even in Glasgow. The Minister of Health would not be a people's minister, but one of His Majesty's ministers, appointed by the Prime Minister, and not in the least degree selected because of his peculiar fitness for the office, and he was convinced that if they had a Minister of Public Health in addition to the Local Government Board, sanitation would not have made the tremendous and gigantic strides which it had made during the last twenty years. What they wanted as sanitarians was not more ministers to put a check upon them, but greater facilities to carry into practice the things upon which they had set their hearts according to their knowledge of the local circumstances.

Dr. Fremantle (Hertfordshire) said he could not help thinking that someone ought to rise to take the opposite line to that which the last speaker had taken, which was a line opposed to the whole trend of modern thought in the sanitary profession, in which there was an almost unanimous opinion of the need of such representation as had been suggested in the excellent paper of Dr. Bushnell. Mr. Anderson's argument appeared to be that the whole question of government was one of party politics as opposed to the real value of the measures which were being considered; and it seemed to him that that was

an absolutely mistaken idea of party politics. In this respect, too, he took a different line to Dr. Bushnell, for he did not think that that gentleman was quite correct in saying that a Minister of Health must be a non-party man and independent of party. He agreed with the words spoken by Mr. Wyndham, who in a recent speech admitted that there were certain difficulties about party government, and he would like to see a really efficient business government in every department; but, looking at the other governments in the world, he saw that the only alternative to party politics was group politics. Mr. Wyndham was surely correct in saying that if they were not governed by parties they were going to be governed by groups, and if they were governed by groups they would be dependent upon the amount of influence which a particular group in Parliament—say, for instance, a medical group or a sanitary group—could gain over other people who were quite uninterested in sanitation; he thought that would put them in an infinitely worse position than they were in at present. So long as they had the present system of party politics they must stick to it and use it for what it was worth. There was no more reason—and no less—why they should have an independent Minister of Health than there was for having an independent Minister at the Board of Trade or at the Home Office, or the Board of Agriculture, or the Local Government Board. It appeared to him that Mr. Anderson's observations as to the manner of appointment of a minister constituted a libel upon the whole system of British Government. Of course, one of the chief things which a Prime Minister must do in choosing his colleagues was to choose men who would be faithful and loyal to the party; so long as they were governed by party politics that must be so. But if a Minister of Public Health was to be appointed the Prime Minister would certainly, with this proviso, prefer someone who had had experience in sanitation of one kind or another. He hoped that there would be other speakers who would endorse his opinion that Bailie Anderson's speech was against the whole trend of modern opinion amongst those who were working in sanitation.

Mr. William Whitaker (Chairman of the Council, Sanitary Institute) said they had had quoted by Bailie Anderson that very extraordinary paragraph in the papers which stated that the War Office and other officials were paid at a higher rate than the Local Government Board Officials because greater intellectual capacity was needed. Well, he did not know whether it was needed or not, but certainly they had not got it. He had been acquainted with many Local Government Board officials, and they had very distinct intellectual capacity and made very good use of it. They were subordinates, of course, and the Board was responsible for the ultimate action taken upon their reports, but they did a lot of excellent work. He thought all who had had to do with Local Government Board officials would say that they were a very able body. A good many of them were recruited from the public health officials of the country. If the Local Govern-

ment Board wanted a medical inspector they generally selected a public health officer, and they got very good men indeed. He had been somewhat staggered by Bailie Anderson's extreme views. Bailie Anderson said the great thing they wanted was non-interference and to be left alone. Surely he knew that the hardest task that they could impose upon any human being was to get him or her to leave things alone. Departments were very much the same as individuals, the collective human being liked to interfere just as the individual did. This had been a very academic discussion on the question of the appointment of a Minister of Public Health, and whether or not the right men were taken to be the heads of great offices. As a matter of fact it did not matter whether they took the best fitted man for the Ministry of Public Health so long as they took a man who was a decent man and knew how to behave himself. It was the permanent officials who did the work, and told the Cabinet Ministers what they had to do. In nearly every department it rested with the permanent officials, unless, sometimes, there was a strong man at the head, who went a little beyond the permanent officials, and then no doubt he led them a pleasant life; but in English Government the Cabinet was a passing quantity, whilst the permanent official lasted for ever. When one official went another came with a long tenure of office; and that certainly suggested the point which was very important that until the sanitary officers of the country had a more permanent appointment they were very often not able to do what they ought to do. But he thought they must know that there had been cases where public health officers had done their duty in despite of what might happen. All honour to those brave men who had thus used their official position to do what they thought was right, though not for their own advantage.

Dr. J. F. J. Sykes (St. Pancras) said it seemed to him that the meeting was thinking of two questions which practically met at one point. The resolution raised the question of the appointment of a Minister of Public Health. Bailie Anderson on the other hand observed that a place like Glasgow wanted to be independent of a Minister of Public Health. Dr. Herbert Jones said that a place like Little Puddlecombe would very much like to be dependent upon a Minister of Public Health. So it was a question of a fight between the big city and a little village, and where the trouble came in was that they were trying, as usual, to treat different diseases with the same remedy. In the one case they wanted to be let alone because there was a capable local authority dealing with matters; in the other case interference was wanted because there was not a capable local authority. The matter of whether or not there should be a Minister of Public Health was really a matter of general policy; but the question of the control of the Minister of Health through his department over the small rural authorities was quite another matter; and minister or no minister there must be that control.

By 54 votes to 24 the meeting passed the first of the resolutions embodied in Dr. Bushnell's paper as follows:—"The members of this Congress are of the firm opinion that the national health would gain by the appointment of a Minister of Public Health and the separation and enlargement of the Medical Department of the Local Government Board into a Health Ministry.

The second resolution in the paper was not put.

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council upon any resolution are published in the page preceding the Law Reports.

THE ESSENTIAL QUALIFICATIONS OF A LADY HEALTH VISITOR.

By Miss E. M. EVANS.
(Associate.)

IN pointing out what I regard as essential qualifications of a health visitor, I should perhaps first state that I have been brought to these convictions by watching and taking part in work, municipal, parochial, and for private associations, which comes within the scope of a health visitor, and that up to this time the reports of similar work in other cities where a lower standard is required only strengthen my opinion that the ideal woman for the work is a woman of position, education, and strong character.

With regard to position I would for choice draw her from the families of those who have a recognised professional or mercantile position in the town, a woman sufficiently above those amongst whom she works as to be unconscious to a great extent of class difference and able to hold intercourse with the poorest classes without condescension, having that sort of easy dignity which permits a woman to talk to her fellow women simply from the womanly standpoint without regard to class, education, birth, or income.

Her education should be that of an ordinarily well-read, well-informed woman of the world, with the extra knowledge required by such an examining body as The Sanitary Institute, some nursing training notably among out-patients, and such valuable knowledge as is gained by a woman who has always regarded work amongst her poorer neighbours as part of her daily life. It is a truism to say such knowledge is never wasted, but the fact that it is often overlooked makes one repeat that such experience is mainly responsible for developing sympathy with others' difficulties, and a practical shrewdness in suggesting remedies.

The actual knowledge required is of various kinds, and when I speak of the examination of The Sanitary Institute, I would beg every woman who is regarding its diploma as the key to her future livelihood, also to regard it as a preparation for acquiring more knowledge as she gains in experience.

My ideal health visitor must have the eyes of an inspector for defective and insanitary house property, the observation of a good housekeeper as to food, clothing and management, the quick perception of a nurse for symptoms of disease, an easy tactful method of imparting knowledge, and she must have the capability of being an official without appearing official.

She should understand the duties of a district nurse, but she must not nurse; she must arrive at all the family particulars, but she must not give alms: she is not a relieving officer.

She should take cognisance of all sanitary defects, unhealthy crowding and surroundings. She must be a small part of the machinery of the Health Department, but she is not an inspector.

She must be able to keep books, and must cultivate the habit of transferring her experiences to paper for the benefit of her fellow workers and the interests of those in authority.

She should have the details of all public philanthropic organizations in her mind ready for use amongst the poor, so as to prevent available charities being wasted, abused, or allowed to overlap.

She must be willing and anxious to absorb knowledge in all branches of public health, and she will find none are more ready to help her than her own medical officer and the inspectors for whom, and with whom, she works.

She should be able to lecture—many courses of lectures on hygiene and sick nursing have been given in the city in which I am interested with excellent results. Large employers of labour have thrown open their warehouses and factories to our lecturers, and have expressed great satisfaction with the work done. Much more could be done in this direction.

In order to show the necessity of employing the kind of woman for whom I plead, it will be best to give a few details of the scope of the work for which she is available.

First, I regard the notifications of the school authorities as a most useful opening, they give an opportunity of visiting at a time when the mother of the child is in difficulties and is ready to receive sympathy, advice and instruction, and there is no doubt that the spread of infection can be largely regulated by direct instruction during the attack as to quarantine, disinfection and so forth.

The direct communication between visitor and mother at such a time has many advantages, and amongst other things the former may then help to dispel the ignorance and indifference of the mother of a family who has grown up with the traditional conviction that all her children must have

measles and similar complaints and that the sooner they have them the better.

In some of the reports of medical officers lately published this ignorant superstition seems to be an acknowledged difficulty in dealing with the poor, but we find that at a time when the mother is in trouble with her children she is often much more ready to heed, and with time and patience such mothers may be induced to believe that prevention is better than cure. We, who look upon ourselves as more intelligent, have not been very rapid, even after we have absorbed such a belief, in formulating and carrying out effective practical measures in this and other sanitary reform.

It is curious to notice amongst the cases we get notified through the schools that amongst the so called bad throats, blister pox, sore heads and the like, our visitor sees children, to whom no doctor has been called in, who turn out to be serious causes of infection and links in a chain of scarlet fever and other diseases which otherwise would not have come to light. One case of the sort I may quote:—Boy reported ill with sore throat, our visitor sees the boy and the entry in her book is as follows:—

"Boy had sore throat and rash, is now peeling—has had no doctor, mother says not necessary—only scarlatina (?)—that they had kept him apart a bit and were using a disinfectant—is very indifferent about the harm they may be doing—they keep a good sized fruit and confectionery shop. Reported case to medical officer of health; steps to be taken."

The visitor comes also in direct contact with the school teachers, amongst whom her advent is welcomed, and who aid her investigations in a most spontaneous and whole-hearted way. They can and do give our visitors valuable advice as to the condition in which certain children live, and will often ask our visitor to call at certain places where they know advice is badly needed, and where precautions recommended tactfully may often prevent serious consequences; or they may say, "We have several children absent in such and such a street," the cause for absence may be the same thing, and on investigation it may be found to be the beginning of an epidemic, which by careful advice and instruction in the first instance may be stopped.

We feel that the connection between our visitors, the teachers, and the children is most valuable, an almost limitless scope for work, and fraught with infinite possibilities.

A very important phase of this work is the visiting during the period of that fatal epidemic, summer diarrhœa. In the city in which I am interested, notices are being issued amongst all classes of schools and institutions asking for notification of all such cases, and it is strongly hoped that the advice given by visitors will tend to lower the rate of infantile

mortality during this period. It will afford one more opportunity to our visitors to speak seriously on infant feeding—a subject upon which the ignorance of mothers is so gross and so fatal that it is hardly credible to ordinary people. Breast-fed babies who are still breast-fed at two years and over, and hand-fed babies whose diet is either soaked bread or ordinary adult food, are very common sights to people who see much of the poor; and from such a generation we, as a nation, expect to raise an army and a navy second to none in the world.

Cases of phthisis discovered whilst visiting, or voluntarily notified by medical men, will form a large and interesting part of the work.

Those unfortunate patients who cannot be removed from their miserable surroundings from want of funds, or because of the hopelessness of their case, can still be helped by our visitors' knowledge and instruction to live more comfortably and easily, and to prevent themselves from being a source of serious danger to their friends.

Again, we as a nation look to the solving of the housing problem for the saving of the masses, but if the problem is attempted to be solved only by bricks and mortar, there is little hope for our struggling, over crowded people. We must first teach the people cleanliness and decency, help them to improve the dwellings they already have, show them how to make the best of them, and the most possible way seems to be through the house-mother. Convince her of her dirt, show her the way to be clean—if she once sees the necessity she will make the lives of the family a burden to them until they are clean too—but transport a dirty, thriftless, ignorant family from a two-roomed hovel in the slums to an absolutely new, up-to-date artisan dwelling, and in a very short time the condition of their new home will rival the old one in misery and dirt. The health visitor who can, during her visit, listen with sympathy to the long story which inevitably falls from the lips of the mother as to all the disagreeables and miseries of the present abode, and who uses her observation as to the truth of the statements, adding many particulars on her own account, can be an enormous power in improvement of house property, both through the owner and the tenant.

There is no doubt the lady rent-collector who has worked on Corporation property has done very much towards improving such property, keeping it in repair and encouraging tenants to live decently, and such a system might with advantage be pressed amongst private owners.

I do not think any of us have much doubt that individual attention to individual cases is the only way of practically helping any cause or any class, and that if we, as a nation, could bring ourselves to look to

some of our continental neighbours for instruction, we might also bring ourselves to adapting or adopting some such system as the Elberfeld for the benefit of our people.

I have refrained from speaking of the work done in other towns by means of visitors drawn from a similar class to district nurses, because I would not underrate the value of their work in the least.

No one who has seen even a small amount of district nursing can have any but the highest opinion of the value of the work, and of the self-sacrifice shown by the women who undertake it, but my principal point lies in the fact that, as the scope of the work required from a health visitor is so much wider and deeper, so the woman who undertakes it must have a broader outlook, a deeper cultivation, a finer sense of the fitness of things, and a consciousness that through all the depression of dirt and disease she carries knowledge and power which may and must prove light and life to darkened homes and unhealthy families.

Here, also, I should like to refer to the excellent work done in many towns by women inspectors, and for whom in most large towns there is plenty of work amongst female workers in factories, warehouses, and shops, but with whose work the health visitor neither interferes, nor does the work overlap.

Finally, if we engage such a woman for our work, we must give her an adequate salary. She is a gentlewoman: enable her to live as one and enjoy her well-earned leisure in surroundings which will help to give tone to her work and rest to her mind and body.

And with this recommendation let me add a suggestion to all municipal bodies who are contemplating this work, that they start it with the most able woman they can obtain, rather than with a staff of two or three of a lower class with lower pay.

One woman of good standing, education and method, with a high standard of work always before her, will accomplish honest, thorough, even brilliant work, and will organize and lay plans for herself and future workers on lines which will not degenerate—whereas if you start work with the other sort of workers it will have to be organized, suggested, planned, probably by the officials of the Health Department, who will always have the responsibility of trying to raise the standard both of the work and the worker's ideal. Such a start of work is not the thin end of the wedge, as at first sight it appears, but a putting up with the less good because the best is not fought for in the first instance, and surely the best is worth fighting for.

Dr. Alfred Hill (Birmingham) said he did not rise to offer the least opposition or objection to the paper, but wished to speak of the qualifications of the lady health visitor. It was desirable that her general education should be good, and the more of a lady the health visitor was in refinement and education, the more influence she would have among the people whom she visited. She must certainly have a large experience in the work, and ought especially to be acquainted with nursing. There was so much to be done in the families of the poor in the way of instructing in the management of children and sick people in the house that a knowledge of nursing was a most desirable qualification. The lady health visitor, moreover, must be sympathetic and have tact, without which she will never succeed. There was more done by tact probably than by any other quality. She must not be called an inspector. Inspectors were looked upon with something like dislike. Their duties are supposed to be rather of an inquisitorial than of the advisory character, and they thus became unpopular alike with tenants, property owners, and agents. Inspectors' work lay outside the house: to find insanitary defects, including structural deficiencies, bad drainage, and uncleanly practices. The inspector had little experience inside the house, and was not required to go there very much, and could not move about and go upstairs and inquire into the interior sanitary arrangements as a woman acting as a health visitor could. The duties of the inspector were widely different from those of the health visitor. The health visitor might do a great deal in the way of instructing young wives in domestic duties. It was astonishing how ignorant such young wives in the lower classes were of domestic management. They rushed into matrimony without the least qualification, and the services of the lady visitor among these young women was an enormous advantage. Cases of sickness of an infectious type were allowed to go on breeding the germs of disease in the house simply through ignorance; scarlet fever, small-pox, measles, and other diseases occurred without any doctor being called in, and it was a most valuable thing to have the lady visitor there to advise the family, among other things, when to go for the doctor. She could also recommend the mother how to nurse her children and feed them, for some women seemed to think that their children could live upon anything and without attention. The health visitor also had an opportunity of recommending suitable cases to charitable and philanthropic institutions. A great deal of good work was being done in that way. Frequently people were dying of neglect, starving to death without knowing it: so ignorant and depressed that they did not even realise the dreadful conditions under which they were living. All these duties ought to be recorded on a sheet by the officer on returning to the office in the afternoon, so that all the facts observed, and all their recommendations made, should filter through the Medical Officer of Health. This was important, because it put the medical officer *au courant* with what was going on. Everything should go through the medical officer, and thus converge on one point, and so be done on a good system and with more weight behind it than would be the case if each individual lady visitor

was communicating with charitable and philanthropic institutions herself. In Birmingham they had twelve women health visitors at present, and he was pleased to testify to the excellent way in which they were doing their work. He looked upon the services of health visitors as among the most valuable of any municipal services, because these ladies got just to the right cases, getting to the people who most needed help and giving them that help in such a way as no other instrumentality could. At Birmingham they had recently thought it desirable to appoint a superintendent lady visitor, to bring the work together and supervise it and give advice and assistance in cases of difficulty. Each day the superintendent accompanied one health visitor round her district in the morning. In that way she was able to keep an eye upon the kind and quality of the work that they were doing, and if necessary to suggest the course that they should adopt. The superintendent collated all their reports in the afternoon, and communicated with the medical officer in regard to anything which was important, next morning, or earlier if necessary. It was an admirable system. It was a great thing for officers to know that they were under systematic control and observation. He was very much pleased with the results of the work of the superintendent lady visitor. The total results of the work were better than they could have reasonably expected, and. as Birmingham had 500,000 inhabitants, he had no doubt that as the work of the present lady visitors had proved so satisfactory they would presently be appointing more. Their work was heavy and depressing and trying, and therefore whenever a visitor reasonably wanted to go to a wedding or to have a day's holiday he always gave permission at once; and he had suggested to his committee, though that body had not yet acted upon it, that health visitors should have Saturdays off altogether. As it was the Saturday was a short morning, and by the time they had visited the office and got upon their districts, some of which were at considerable distances, little time remained for actual work.

Mrs. Greenwood (Sheffield) said she thought that all the qualifications which had been mentioned as so essential for the lady visitors were equally essential in the sanitary inspector under a Corporation. A gentlewoman with special training, whether she was called a health visitor or a sanitary inspector, would do the work infinitely better than an untrained or an uneducated woman. There were women who had been working as health visitors in a semi-official capacity who had done most excellent and valuable work, just as there were excellent women who were doing splendid work as sanitary inspectors. In Sheffield they went from house to house instructing mothers in the cleanliness of the houses, the feeding of infants, and the prevention of diseases. She believed the value of the work done, whatever name the lady was called by, was entirely in proportion to her education and ability. Her own experience was that in a large town like Sheffield there was a decided advantage in having the established position of a sanitary inspector under the Corporation. With the

authority of that position she could get into houses and deal with cases which she could not otherwise touch. She thought it was a contradiction to say that a woman should have all the qualifications of an inspector and yet not be an inspector. In regard to Dr. Hill's suggestion that women inspectors should not work on Saturday mornings, it would of course be very nice to have the time to themselves, but in Sheffield they found Saturday morning a useful time for seeing the children at home, whereas on the other days they were at school. At Sheffield they were doing some work among the school children in getting them sent to school in a much cleaner condition than had been the case in the past.

Miss Lovibond (Bedford College, London) said that when a lady health visitor had done all that seemed to be required of her she was an inspector whether she was called so or not, and she had found from her experience that if the lady was called a "health visitor" misconceptions were constantly arising. People, believing that she was only working under some charitable institution, did not understand that she came with the authority of the health committee, and it was only when this was explained that difficulties of entry and inspection vanished. If the lady visitor stated that she came with the authority of the medical officer of health and from the health committee, she found the people themselves appreciated the fact that she had a good backing of authority behind her, and would carry out the instructions given to them with greater readiness. Some there were, of course, who were ready to take their advice willingly, whether they were health visitors or sanitary inspectors, but there were many difficult cases in which people would respond more readily to the advice which was given them, if they knew that disobedience was likely to be followed up promptly by notices from the health committee. She thought that there were a great many ladies keenly interested in the subject, and anxious to take up the work, but, having trained themselves and spent the necessary money upon a good education and the special technical training required, they wished to know whether there was a reasonable prospect of a fair return for it. She was told when she came to the North that she would find good business men, but she did not think it was in accordance with good business to pay twenty-five shillings a week to a woman who must be twenty-five years of age (as a rule), and well trained, and have the same qualifications as a man, and must have various other qualifications which all took time and money to obtain. With such a salary they could not pay their way, and she considered that those parents who had laid out their money in giving this sound education *were* entitled to some return; not to have still to support their daughters after they were working. They had to teach thrift to the people; and she had very often been in terror of some of those to whom she had spoken about thrift turning round upon her and asking, "Well, what are you doing towards putting by for the future, and what are you doing towards supporting your parents?" Candidly she was doing nothing

towards supporting her parents, and not very much towards providing for her own future, simply because with present salaries it was not possible.

Miss Homersham (London) said she wanted to know what the prospects were of an opening for trained nurses as health visitors. The nurse's training was a long one, lasting three to four years, and besides, it would be necessary for the health visitor to have The Sanitary Institute training also. From the financial point of view what were the prospects of women health visitors, and what was the technical difference between their position and that of the lady sanitary inspector? They knew that a great many nurses did go in for The Sanitary Institute certificate, and, having obtained it, they endeavoured to get the post of lady sanitary inspector. When that failed, she supposed, one must regard the health visitor as a post of lower grade. She should like to know what the average salary of each was, and also what arrangements there were with regard to holidays. Nurses were a hard worked body of women, working seven days a week, and it was suggested that health visitors should work five only. The holiday that the nurse expected was at the utmost a calendar month in the year, and that was little enough—not making up for the Sunday work all through the year. On the other hand she was provided with board, lodging, uniform, and laundry, and received a salary averaging £35 per annum.

Mrs. Greenwood (Sheffield), rising in response to a suggestion from the President, said that in London women sanitary inspectors were generally better educated and better remunerated than those in the provinces. The highest salaries in London were from £150 to £180 a year. A great many began at £110 and went up to £150 or £160. She did not think at first all the London vestries paid so much as that, but when they found that their best women were being selected for other posts they had to raise their salaries in order to retain them. As to the provinces she believed that in Liverpool the salary began at thirty shillings a week and went up to nearly two pounds, and there were other advantages. Two costumes a year were provided, and money was allowed for shoes. Over three weeks' summer holiday was given, and there was a superannuation scheme. In St. Helens the salary began at twenty-four shillings and rose two shillings a week. In Rochdale the salary began at thirty shillings. At Oldham the salary was thirty shillings a week, rising as the value of the work was appreciated. In nearly all these cases the Corporation provided costumes for the lady inspectors. In Sheffield the chief inspector's salary began at £120 and rose to £150; assistants began at twenty shillings and were now getting twenty-two shillings and sixpence per week. The Birmingham lady health visitors began at twenty-five shillings. In Manchester the workshop inspector began at thirty shillings a week, and the salary went up to two pounds. The

health visitors in Manchester are paid sixteen shillings a week. Leeds made a great point of having educated women, and she believed they paid about £70 to £80 a year to begin with.

Dr. J. Spottiswoode Cameron (Leeds) said he totally disagreed with one position taken by the reader of the paper. That was the suggestion that though these ladies were to be attached to the health department they were not to be inspectors. He did not want any lady visitors in his health department who were not inspectors. If they were not inspectors what were they? If they were to have all the qualifications of inspectors why not call them inspectors? At Leeds all the ladies employed had either the certificate of The Sanitary Institute or the certificate of the Sanitary Inspectors' Examining Board joined by The Sanitary Institute and other bodies. In addition to the fully qualified ladies, they took a couple of probationers for six months, coming as learners because, although they had the excellent certificate of The Sanitary Institute, it did not at all follow that they knew very much about the practical work of an inspector. As soon as they came to the Leeds department they were put on to house-to-house work under the direction of one of the more experienced men inspectors. They visited every house in the district assigned to them from top to bottom, and were required to know practically everything about drains and traps and sinks. They had previously read about these things in books, but had not generally seen much of them before coming to the department, and the Leeds authorities considered that it was essential that the lady inspector or health visitor should know all these things practically. After having gone through a certain amount of training in that way, they were sent to inspect the factories where women were employed, and also to mixed factories where both sexes were employed, and he did not think he need insist at that Congress upon the importance of having women to go and look after the conveniences in these places instead of the medical officer having to do it himself. They all knew the inconvenience of having to make arrangements by which a woman had to go first, and then a man had to go to confirm what she reported. He did not like to keep duplicating his work, and therefore, instead of having the lady inspector making a report to a man inspector, and his going to see if it was right, and then handing the report over to the chief inspector, he liked the lady to be able to make her report direct to the chief inspector at once. In Leeds the lady inspectors could do that. Another part of their work was that of looking after schools. Every infectious disease case was inquired into first of all with regard to the house at which it occurred, and they also inquired secondly into the condition of the place of business or school; and in regard to this matter the assistance of the ladies had been most helpful to him. He found there was a special advantage in their looking about the schools. Some of them were trained teachers themselves, and so were all the better able to see that the children were properly looked after, and they, of course, could talk to the school mistress in a

way in which the man inspector could not, for very often the man inspector belonged to a class which was not at all superior to that of the teacher in the elementary school, whereas the lady inspectors that they had in Leeds came from the middle classes and held a position which gave them a better standing with the teacher. The inquiry into the condition of the schools was very much helped indeed by the lady inspectors. Then, as he had said, these ladies had to inspect the workshops also, and in this respect they would do very badly if they were not called inspectors instead of health visitors, for they must be in a position to threaten notice at once if instructions were not obeyed. At present he had a lady inspector visiting every house in a large district of Leeds in which a child under two years of age had died. She went to the house and had a little sympathetic conversation with the mother, looked at the house from the point of view of the inspector, inquired into how the little child had been fed, and inquired, in a way in which a man could scarcely do it, into the particular circumstances of the family which had given rise to any malformation on the part of the child, and inquired into the family history as to tubercle or any other disease which she could get information of, and so on. All this information was included in the medical officer's returns, and was exceedingly useful. Of course, in going about inquiring into the cause of death in this way, and looking at the premises, the inspector was able to get a word of advice in here and there, and there were generally some other women coming in and out of the house who heard what she had to say. When they got a dozen inspectors instead of half-a-dozen at Leeds, he hoped to be able to accomplish a house-to-house visitation carrying out the whole of the programme of the reader of the paper; but he must have inspectors and not merely health visitors.

Dr. W. Butler (Willesden) said the discussion had taken a turn as to what the lady health visitor or inspector should be called. He thought most medical officers would be of opinion that the lady health visitor should have the status of a sanitary inspector. But women had a distinctive work. It was not a question of equalising in this case, and it was always a pity when a contest took place between men and women in similar employment for what was called equality. What was wanted was difference. The woman's part was her own, and it was in her own sphere that the lady health visitor would succeed. No one wished to minimise its importance, but they did wish to emphasise its distinctiveness and difference from other visiting work. By all means let the lady health visitor have the legal status of an inspector, but lady health visitors would make a mistake if they insisted, as they largely had done that morning, on being known as sanitary inspectors. The word "inspector" was not comprehensive enough, it meant a passive rather than an active agent. Lady health visitors were much more than inspectors, and while he would urge them to obtain the status of inspectors he hoped they would obtain the title of lady health visitors.

DR. H. COOPER PATTIN (Norwich) said that in the city he represented they had got over the difficulty of title. They had appropriated a lady who was known officially in the records of the corporation as the "Female Sanitary Inspector and Health Visitor," and she was known colloquially, and in his office as the "lady inspector." So that all practical difficulties had been got over in that respect. And he would like to say that he considered her work to be so satisfactory that he would like to see colleagues appointed to work with her. He had himself tried to get the addresses of homes in which children were born, being anxious if possible to see to their proper up-bringing, at any rate as regarded their artificial feeding. That was, of course, in cases where he thought it necessary. He tried to get returns from the Registrar every week, but he was sorry to say that some piece of red-tapeism intervened, and the returns had been refused him for the present. He was going to try and see if he could do anything in London in regard to the matter. His hearers would appreciate the importance of this information being given systematically, because the medical officer, in cases where it was needed, might be sure that mothers would derive valuable assistance from the visits of the lady inspector. In Norwich they had not any large cloth factories such as existed in the North, but a considerable amount of clothing was made in the home, and in many cases much good had been done by periodical visits to those outworkers' houses. It was everything to have a well-bred person, and in Norwich they had got hold of a lady of the right type. She was twenty-two years of age, and had the certificate of The Sanitary Institute, and the comment made about her by some people whom she had visited was to the effect that "whatever else she was, she was a lady." He knew in the first place that she would get on with the people because she possessed tact. He agreed with Dr. Hill that the work of a lady visitor was to be a missionary. Her crowning qualification ought to be a knowledge of practical cookery; she ought to be able to go into the homes of the poor and give instruction in practical cooking. It was not a truism, it was a bald statement of fact to say that the better people were fed the better nation they would make. People should realise that; therefore, the ideal lady visitor should be able to give instruction as to the proper feeding of the newly born child, *i.e.*, if it had to be fed artificially, and she should also be able to instruct the mother if she found that mother doing her cooking in an utterly unscientific and extravagant fashion. Dr. Hill had mentioned some curious things he had learnt about the feeding of children in Birmingham. They in Norwich had also learnt some curious things. In one instance a child was apparently being brought up quite healthily upon bottled stout, and, further, the mother declined to alter this diet. There was one thing more he wished to suggest. If they wanted to get inspectors of the type he had outlined the authorities must be prepared to give them a proper rate of pay. He had tried very much to get the female sanitary inspector in his city put upon the same footing as the assistant inspectors as regarded her commencing pay and uniform, and the annual increment of that pay. But the committee only felt disposed to provide her with uniform, he suggested to her that, perhaps,

she would prefer a pecuniary payment, and be allowed to provide her own dress. The committee gave her £10, and she dressed herself as she chose. She did not have a band around her hat, in fact, she visited homes in the dress of a lady, and it was in that capacity that her work would be done most effectually. He agreed with Dr. Cameron as to the value of her being really an inspector, and in his district now she issued notices in just the same way as an assistant inspector, and he found that she did so with discretion and with good effect. He would not go into details about holidays, but in his district there were convenient excursions to London at week-ends, and if ever the lady inspector wished to go and see her friends who lived there she had no difficulty in getting the requisite leave. She got very fair holidays indeed. He was so very satisfied with the lady inspector at Norwich that he was anxious to provide her with colleagues, and he would suggest to the Conference that if they had any difficulty as to the title, they should do as was done in Norwich—let her be known as the "female sanitary inspector and health visitor," and they would then do what they instinctively did in Norwich—call her the "lady inspector."

Mrs. J. A. Godwin (Bradford) gave some particulars of what had been done in her city. She was the wife of a member of the Corporation, and she therefore heard a good deal of the inner work of the City Council. When it was decided to appoint a lady inspector she was asked unofficially to secure names of ladies whom she and others considered suitable for the post. Many of the Corporation officials thought at the time that the office was absolutely unnecessary—that Bradford did not need a lady sanitary inspector. The salary which was proposed was ridiculously small; one would scarcely have got a good cook at the price. Her husband and others insisted as far as they could upon the very highest salary being offered. His contention had always been that if Bradford wanted to be well served it should offer a good salary, even if it was never advanced. Miss Stevens came and, although at first she met with a good deal of opposition, her influence in the slums had now become so great that the only danger was lest she should feel compelled to spend every minute of the twenty-four hours going round to see the people. This official had come to be regarded as the saving clause in the Corporation, and the office was certainly a permanency. Mrs. Godwin instanced a case of good done by the lady inspector who had exercised a wonderful influence upon a poor drunken woman, with the result that she had been a staunch teetotaller for two years. One of her principal reasons for speaking was to urge the importance of that quiet educative work which a lady could do. She could go into places where a policeman scarcely dared go, and could do the work of regeneration, according to her idea, more effectively than anything else, for it must be physical regeneration before it could be moral. The Corporation were now so alive to the importance of the work of their lady inspector that they had appointed an assistant, which she hoped would be but the beginning of several more such appointments, for they were, she regretted to say, sadly needed.

ARE THE CHIEF CAUSES OF INFECTIOUS FEVER CONNECTED WITH VITIATION OF AIR OR WITH WRONG FEEDING?

By A. RABAGLIATI, M.D.

A GREAT sanitarian has said that of all the causes of disease, bad air, or vitiation of air, is the most important; and on this statement of opinion a great deal, if not all, of the sanitary effort of the last fifty years has been founded. I do not deny the importance of air-supply, nor do I demur to the efforts or the cost of the efforts which have been made for fifty years to improve air-supply, but I do not think that the chief cause of fevers is bad air: I think their chief cause is wrong feeding, and in particular, too abundant and too frequent feeding.

What has been done? What have been the effects of the sanitary efforts of the past two generations? I know of two only. 1st. A great reduction has been effected in the incidence and in the mortality from consumption. 2nd. A reduction not quite so large, but still considerable, has been effected in the incidence and in the mortality from the continued fevers. 3rd. As a corollary to these two results the average duration of human life in England has been increased; but there appears to be more sickness than there used to be. We have become more valetudinarian. The mention of consumption—which has fallen as a cause of mortality from about 2,800 per million per annum in 1869 to about 1,300 now, and this independently of the crusade instituted against it—along with the fevers, is necessary for the following reason: The fevers (scarlet fever, measles, typhoid, cholera, influenza, and diphtheria are examples of these, and so is small-pox) and consumption differ from the inflammations in this way: The fevers and consumption are febrile diseases which are either known or are believed to be associated in their course with the growth and development of micro-organisms in the blood and tissues of the body. The inflammations on the other hand are febrile diseases which are not known to be associated with the growth and development of such micro-

organisms. This means of differentiation between the fevers and the inflammations sounds striking and far-reaching until it is examined. I believe its importance to be much exaggerated. Most authorities even say fevers are *caused* by micro-organisms flourishing in the body, a doctrine which I am sure is unsound; and its unsoundness is proved by the failure of Koch's attempt to treat tuberculosis by serum injections of tuberculin. He tried to treat the micro-organism rather than the body of the person in whom it grew, and he failed as all such attempts must fail. Similar treatment in the fevers will fail also. Further, although simple inflammations are not known to be associated with the growth of micro-organisms in the blood and tissues, the progress of bacteriology is so rapid that it is quite likely that before long inflammations also will be found to have each its own micro-organism, in which case (by no means an impossible one) the differentia between the fevers and the inflammations will disappear. Even at present the "specific inflammations" are being gradually removed from the inflammations and classified with the fevers. The great difference in the popular notion between the fevers and the inflammations is that the former are *infectious* and the latter not. But many inflammations, as sore throats and colds, are notably infectious (at least, several inmates of the same house get them simultaneously or successively), so that this difference also becomes less as we examine it. Then the fevers are held to be preventible, the inflammations not. But I am persuaded that the inflammations are as preventible as the fevers. The fevers are said to be preventible. I have been hearing this for nearly forty years, but they have not been prevented although they have been reduced. Let us see the facts. On the average of the years 1850–54 the mortality from the zymotic diseases in England and Wales was 5·240 per 1,000 per annum; in 1876–80 it was 3·823 per 1,000; in 1881–85 it was 2·804; in 1886–90 it was 2·502; in 1891–95 it was 2·747; and in 1896–99 it was respectively 2·549, 2·591, 2·761, and 2·811, giving an average mortality for the four years of 2·678, which is actually higher than the average mortality of 1886–90, or ten years before. Roughly, however, we see that the fevers have fallen 50 per cent. in fifty years.

But I want to ask a question here. If we had been dealing with the whole of the causes of fever, ought we not to have effected a greater reduction than 50 per cent. in fifty years? And does not the fact that we have failed to do more than this raise a presumption that we have not had a complete view of the causation in our minds? I confess that this is the presumption in my mind. I think we have been overlooking an important part of the cause. When we know the cause of other diseases,

as *e.g.*, bronchitis, we can prevent its occurrence up to say three quarters or nine tenths of its incidence. We ought to have done the same for fevers but we have not: Why? Besides this, what about influenza? Influenza is a fever, for the micro-organism associated with it (many say *causing* it) has been differentiated and cultivated; and during the last eleven or twelve or more years influenza has attacked the people vehemently. How is this? Influenza, which had accounted for under 100 deaths per annum since 1881, in 1889 suddenly accounted for 4,523 deaths; in 1890 for 16,686; in 1891 for 15,737; and in 1892 to 1900 for 9,669, 6,625, 12,880, 3,758, 6,088, 10,405, 12,417, and 16,245 respectively. How is it that influenza, a fever, increases in spite of the most persistent efforts to obtain good air-supply, efforts never intermitted, but on the contrary, much increased of late years? It seems impossible that the theory of bad air can account for the presence and even the increase of influenza. My suggestion is that the chief cause of influenza is not bad air but wrong feeding; that it is in fact due to taking too many meals—a cause which seems to me an increasing cause of late years among the English people.

Now, what would be a scheme of complete proof as to the causation of illness? If, firstly, persons exposed to the alleged causes got the illness; and if, secondly, after being freed from the action of the cause they ceased to get it; and if, thirdly, re-exposure to the action of the cause brought the illness on again, we ought to be satisfied with our proof. Unfortunately, there is a fact about fevers which renders them unamenable to this line of reasoning, and it is that fevers do not as a rule occur twice in the lifetime of the individual. We can deal with a recurring inflammation, sore throat, headache, bronchitis, much more certainly: and it is really rather easy to prevent the recurrence of these inflammations. But not the fevers, because they do not recur. (What happens is this: the same fever does not recur; but an inflammation or another fever occurs. The patient does not take scarlet fever twice, but he gets diphtheria or some other fever, and so the nexus is not seen. But I must not go into this.) But influenza does recur. Some persons have it many times, as often as a dozen times, and some oftener. Is influenza caused by bad air? If so, how do the members of the House of Commons suffer so much from it that the House is said to be poisoned with it? Where is ventilation better attended to than in the House of Commons? And yet anyone who wants to know may discover why the members of the House of Commons suffer so much from influenza; but it is not from bad air and insufficient ventilation. Now take this case. A man, 38 years of age, who suffered from recurring influenza for

four years, was recommended to eat twice a day in place of four times; he did so, and ceased to suffer not only from recurring colds and bronchial attacks, but has never had an attack of influenza for four years. Evidence of this kind frequently repeated has convinced me that influenza is a disease caused by too many meals, and that, therefore, persons need not suffer from it, infection or no infection, if they will alter their way of living. They need not have it at all—but at least if they do, they need not have it with such complications as pneumonia or other calamitous concomitants. A man under a tetrasiteous *régime* gets influenza for three or four years running; under dissiteism he does not get it again. Now, thirdly, if he returns to tetrasiteism I believe he will get it again, or if not, that then some other calamity will befall him. But, of course, I cannot recommend him to make such an experiment, although we can see, if we open our eyes, many persons making the experiment and suffering accordingly.

Now take scarlet fever, a very infectious disease. The same able medical officer of health who tells us that fevers are due to bad air, insufficient ventilation, sewer gas, and so on, also tells us that if he has 20 cases of scarlet fever notified one morning, he at once inquires into the milk supply? Is milk air or food? And yet we hold these contradictory ideas regarding the spread of fever, and do not appear to see the antinomy! Typhoid fever seems generally thought to be due to sewer-gas finding its way into the dwelling; but it is often said to be conveyed in drinking-water, which, certainly, is not bad air. And recently a good deal of evidence has been led to show that sewage-fed oysters may cause it. Here, of course, the bad-air theory is given up. And yet, for all that, we constantly hear that the fevers are due to insufficient ventilation. Take, again, epidemic diarrhœa of autumn, so fatal to children. As to this, opinions seem to be altering, for our medical officers of health advise parents to keep the milk in clean places, and away from sewer-gas—very good advice, no doubt, though it would be much improved if they advised the parents how often to feed the children and how much to give them.

Now there is another consideration requiring attention. In all the cases where fevers are attributed to food-supply, it is believed or assumed that the food is bad. The reason that the medical officer examines the milk when an epidemic of scarlet fever is present is in order to find out if it comes from an infected place, if the farmer or his family has scarlet fever, or the oysters have been sewage fed, or the diarrhœa-inducing milk has been infected by sewer-gas, etc. But I contend that an excess of

good sound food may cause fever; and in fact I believe it often does. In the case related, where alteration of the diet prevented the recurrence of influenza, there was no suggestion at all that the food was unsound; it was simply in excess. When, according to the opinion of Moses, plague was caused among the Israelites at Kibroth Hattaavah by eating too many quails for a day and a night and another day, there is no proof that the quails were bad. The people simply took them too often and too much. And yet Moses, after burying his dead, moved his camp a day's journey to Hazeroth in order to get rid of the infection, which by that time had affected both the ground he was on and the air of the place. The ideas of Moses regarding the causes of fevers appear to me to have been a great deal more complete than those of our modern sanitarians. I have a patient who for over thirty years after leaving the West Indies suffered every time he got a cold from an attack of malaria; also he was in the habit of taking cold continually and repeatedly. When he altered his diet to two daily meals, and sometimes to one, in place of the three, four, or five meals he had been in the habit of taking, he not only got rid of his colds, but for ten years now has had no return of his malaria. We can see this nexus of causation in the case of a recurring fever like influenza or malarial fever, but it is much less easy to see it in the case of a fever like scarlet fever, which as a rule does not recur; and if a patient afterwards gets diphtheria or typhoid fever we tacitly assume that his diet had nothing to do with it, attributing the new illness to a new "infection." We never inquire how he came to be so easily infected, whether for example it may not have been because his blood and tissues were so blocked with the products of digestion that they fell easily under the influence of a very small amount of fever-poison. But many striking proofs of the probability that this is the cause of susceptibility to infection are evident to whosoever uses his eyes. Erysipelas of the face is at least a specific inflammation, if it is not a fever. At any rate, it is associated with the development of a micro-organism in the blood and tissues (I do not say it is *caused* by it). And under the name of "Gallic fire" it has been long recognised that it can be induced by eating sour fermenting bread. But an excess of good sound bread can cause it also, as was shown by the case of a young woman who came to me because she had suffered for years from recurring facial erysipelas. I recommended her to cut down her daily meals to two and to take bread only once a day, and then only to the extent of about four ounces. Her face was so distorted that for about two years she was unable to follow her occupation of a weaver. Under this advice she became well and returned to her work.

But finding herself better, and thinking that she might now behave like her companions, she increased her bread and soon began to suffer again from a recurrence of her facial erysipelas. After being ordered to restrict her bread she again recovered, and for years now has been able to follow her employment. There is not the slightest reason to believe that this girl ate bad bread, sour, fermenting, poisonous; not at all. All she did was to take an excess of good sound bread, more than her economy required. It does not practically matter how the micro-organism accompanying erysipelas got into the blood and tissues. It may have got in through the bread or in any other way. But an excess of bread ingested into the body over-manured the ground, so to say, converting it into a soil suitable for the growth of the micro-organism; and the process made the girl so ill as to be unable to follow her occupation and earn her living. In exactly the same way, treating grass land with basic slag will produce a thick crop of clover-hay, where only small crops of meadow-hay had been reaped before: but the basic slag does not contain the clover seed, nor is it necessary to sow any in order to get a crop. And the new vegetation frequently springing up in a district, after, for example, a deep railway cutting has been made in it, shows us how seeds may be dormant in the ground for many years, failing to grow until changes suitable to them have been made in their environment. That we do not wish the micro-organisms of erysipelas and of fevers to grow in the body, while we do desire the clover crop to flourish, is quite beside the question.

My limits being so restricted, I will now put in propositional form my doctrine of fevers and their causation.

1. Cases of epidemic fevers may be viewed as being due to a common cause; or as cause and effect of one another.

2. The former is the more ancient view; the latter the more modern. Homer attributed plague to the shafts of the far-darting Apollo. Moses to the anger of God because the people ate too many quails. Modern sanitarians say that fevers are due to bad air, but that bad food and bad water are also sometimes causes.

3. The idea that fevers are due to infection, or otherwise, that fevers are cause and effect of one another, is far rather a modern than an ancient idea, although the germs of it are discoverable in ancient times also. In modern times the idea that fevers are due to infection has been pushed to a greatly exaggerated and unwarrantable extent.

4. The problem of preventing fevers is rather to be solved by attempting to make ourselves immune to infection than by the advice to "keep away from it."

5. Fevers are due as their chief cause to over-feeding, even with sound food (still more of course if the food is bad). Bad air is a contributory cause.

6. When fevers are attributed to famine, it seems to me to have been overlooked that in famines, when crops fail, crops are not only short but bad, and that the diseases in the food are a great part of the cause of fevers (notably, the potato-disease in Ireland causing relapsing fever and typhus, and the diseased rice in India causing plague.)

7. The effects of famine would be simple and progressive exhaustion and attenuation and not fever, were it not that before the onset of famine the people's bodies had been filled with digestive products beyond the necessities of the economy. When famine sets in this excess of digestive products goes into oxidation and causes fever.

8. The occurrence of this, that, or the other fever being determined by the growth of this, that, or the other micro-organism, is accidental and comparatively unimportant. What is important is that the patient has a fever at all.

9. The best means to prevent fevers among people leading a town life would be attained by feeding our children twice a day to the extent of about an ounce of food to each 10 lbs., or perhaps each 8 lbs., of their body weight; and the same for adults from 21 to 50 years of age, after which time one daily meal would be much safer. After 75 years of age persons might be trusted to know for themselves what sort of *regime* would be most suitable for them, but very few of us ever learn this simple lesson, however long we live.

10. Until our people learn that they must exercise a certain amount of self-restraint over their appetites they will never prevent the incidence of fevers; the increase of fevers during the last ten years, and particularly the ravages of influenza, very plainly suggesting that we have exhausted the improvements which we may expect from paying attention to air-supply.

Dr. A. K. Chalmers (Glasgow) said they must all feel that Dr. Rabagliati had pictured for them a scheme of living, and laid down for them a counsel of perfection, which might come about some time, but which as yet was very much in the future. It was perfectly true that it would be an advantage to render everyone immune to infection, but the present difficulty was not how to render people immune, but how to cope with those evils which co-exist with us and to which

modern life opened so many doors of access. There were one or two points on which one might be disposed to say something. Dr. Rabagliati said that fevers were associated with micro-organisms, not in the sense that the microbe caused the fever, but that the fever created the conditions under which the particular micro-organism could exist. He should like to ask him how he explained the occurrence of infection, say, in an animal which had been inoculated with plague; did the plague occur with the inoculation as a pure coincidence, or did it result from the inoculation? Dr. Rabagliati had also said that overcrowding did not cause disease, but that it was a question of diet. How then did he explain the decrease of tuberculosis in the Royal Navy where nothing was altered but the conditions under which the men slept? He should also like to ask how Dr. Rabagliati explained the almost total abolition of typhus fever where little or nothing was altered save the conditions of overcrowding which they knew to have existed. It could not be said that these people suffered from typhus because they were overfed, because they all knew that typhus still occurred among that section of the population which was underfed. He should like to add that for the manner in which Dr. Rabagliati had presented the particular thesis which he had in view they must all feel a keen appreciation. He had put before them a conception of a pure life which must always be an ideal to them.

Dr. Richard Lord (London) said he felt bound to agree that there was a vast amount of truth in what Dr. Rabagliati had said about keeping the body immune. So long as thirty years ago he made a statement upon a public platform that, being Surgeon to all kinds of Friendly Societies and also Doctor to several Temperance Sickness Societies, he had had an opportunity of comparing the amount of sickness in these various societies, and, if it were put to him, he was bound to say that he would attend the teetotallers for half the money, and he said that, although he was not at the time a teetotaller himself. Why was it that temperance people had less sickness and lower mortality than the others? Both were exposed to the same germs, and inhaled the same air. He could only conclude that the reason of the difference was, that one class kept their bodies more immune from disease than the other class did. Therefore to that extent there was a great deal in what Dr. Rabagliati said, and it behoved them, as medical men confronted with these problems of everyday life, to consider and utilise every suggestion which was made. Whether the germs caused the disease through the unimmune body forming a nidus for the invasion and multiplication of the germs as Dr. Rabagliati alleged, he ventured to think that Dr. Rabagliati was not far wrong. If they let their bodies get down into a low condition they would be subject to the invading germ whatever it might be. The best thing for them to do was to keep their bodies as immune as possible; but, if bacterial disease unfortunately effected a lodgement, he (Dr. Lord) would resort to the early and free use of anti-toxin, contrary to the belief and practice of Dr. Rabagliati.

DR. RABAGLIATI (Ben Rhydding) said it was very easy to reply. The argument which he had put to them was entirely impregnable and unanswerable. The chief cause of fever was wrong eating, and the second cause was bad air. He had never denied the possibility of infection. If they injected germs into organisms the germs would grow. He might put it this way: suppose it required a thousand germs to cause a properly fed body to take a disease; it would probably require only a hundred to make an improperly fed body take it; and perhaps only ten to affect a still more fermenting body, one still more plugged by overfeeding with fermenting products. The amount of resistance that the body had—whilst one could not raise it above its highest power, was very much increased or diminished according to the manner of life. As to Dr. Chalmers' point about typhus, all epidemic diseases were like men; they had their birth and adolescence and culmination and decline, and at present it was not typhus that was with us but influenza. Why should we trouble about the typhus which had gone? He could recall the day when medical students died of typhus in rapid succession, but it had gone. Do not let us raise these theoretical questions about things which do not now exist but deal with things which do exist. As regards influenza that was our present epidemic, and what he had to say upon that was, that they need not take it if they lived properly, and therefore they need not require doctors to cure it. It was a funny thing to him to hear a doctor saying, "I know all about influenza; I have had it a dozen times myself!" But if a medical man could not prevent it in himself how was he to prevent it in the case of other people? It was a very strange thing that men did not see the irony of such a statement as that. Just a word about the question of the relationship of cause and effect. The human intellect could scarcely say what was cause and what was effect. (1) "The thought is before the thing;" (2) "The thing is before the thought;" (3) "The thought is the thing;" and (4) "Thought and thing make a new creature every moment, so that we are always *becoming*, but never *are*." There they had four propositions as to cause and effect, and what right had they to assume that only one of these was true?

ON WEAK POINTS IN THE SALE OF FOOD AND DRUGS.

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(Fellow.)

ABSTRACT.

THE Acts concerning the Adulteration of Food and Drugs are many, but the chief are:—

1. The Sale of Food and Drugs Act, 1875.
2. The Sale of Food and Drugs Amendment Act, 1879.
3. The Sale of Food and Drugs Act, 1899.
4. The Margarine Act, 1887.

The first Act (1875) was passed to make better provision for the Sale of Food and Drugs in a pure state.

Section 3 states that no admixture must be made so as to render the *article injurious to health.* The words "to render the article injurious to health" should be omitted. Want of knowledge is also a good defence under this section.

Section 6. This is the section under which most of the prosecutions are taken, and it states that "No person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality of the article demanded by such purchaser under a penalty of £20, provided that an offence shall not be deemed to be committed under this section in the following cases:—

1. Where any matter or ingredient not injurious to health has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce, in a state fit for carriage or consumption, and not fraudulently to increase the bulk, weight, or measure of the food or drug or conceal the inferior quality thereof.

2. Where the drug or food is a proprietary medicine and made according to the specification of the patent.

3. Where the food or drug is compounded as in this Act mentioned.

4. Where the food or drug is unavoidably mixed with some extraneous matter in the process of collection or preparation. Now the exceptions here given spoil to a very large extent the benefit of this section, and the difficulty to obtain a conviction is often due to the view taken by the tribunal as to what constitutes "*to the prejudice of the purchaser.*"

I would say with a non-legal training, that any article not being of the nature, substance, or quality demanded, unless declared at the time of the sale, should be considered to be "to the prejudice of the purchaser." If, for instance, a purchaser asks for ground coffee and gets coffee and chicory mixed together, it is to his prejudice; but in courts of law the defence tries to prove that the adulteration is not injurious, therefore is not "to the prejudice of the purchaser"; again, in the sale of potted shrimps, the boric acid not being considered injurious to the consumer, the purchaser was not prejudiced, although fresh potted shrimps were asked for.

Nature, substance, and quality demanded.—It was held that these words could not be disjointed, and that the substance sold must be different in all these respects; but Section II. of the 1879 Act remedies this, for its conclusion states:—"Neither shall it be a good defence to prove that the article of food or drug in question, though defective in nature or in substance or in quality, was not defective in all these respects."

2. *The Sale of Food and Drugs Act Amendment Act*, 1879.—This Act was passed to amend the Sale of Food and Drugs Act, 1875, owing to the conflicting decisions given in England and Scotland, in regard to the meaning and effect of Section I. of the 1875 Act.

3. *Sale of Food and Drugs Act*, 1899.—This Act deals with the importation of Agricultural and other produce insufficiently marked.

4. *The Margarine Act*, 1887.—This is an Act for the better prevention of the fraudulent sales of margarine, and was passed for the purpose of protecting the public against the sale as butter of substances made in imitation of butter as well as butter mixed with any such substances. The weak points in the Margarine Act is the difficulty of getting at the offenders. The rogue who sells margarine for butter knows the inspector, and when butter is asked for he either gives butter or says that he only sells margarine. If an inspector could demand a sample from a recent purchaser without that purchaser having been sent by him so as to constitute agency and then divide the sample according to the requirements of the Act, we should be able eventually to put down the dishonest seller of margarine for butter.

CONGRESS AT BRADFORD.

SECTION II.

ENGINEERING AND ARCHITECTURE.

A COMPARISON OF CHEMICAL AND SEPTIC TANK SYSTEMS AS PRELUDES TO ARTIFICIAL FILTRATION.

By DOUGLAS ARCHIBALD, F.R.Met.Soc.
(Member.)

ONE of the most prominent features of modern sewage treatment and disposal has been the substitution of bacterial decomposition for chemical precipitation in tanks, before any subsequent filtration over land or artificial beds.

The main impulse in this case has been not so much the desire for greater purification, as for the elimination of the sludge, and the supposed concomitant economy due to a saving of the chemicals and sludge-pressing.

Even supposing both such economies to have been effected, the problem would not necessarily have been solved. It will always remain a complex function of several variables, all of which have to be considered when we endeavour to find a minimum solution. Efficiency in regard to purification, limitations of area, depth, local nuisance, capital and annual expenses, renewals, etc.

I think it will be conceded that, as time has progressed, the optimistic dreams of the out-and-out bacterial iconoclasts have become considerably modified.

Initially we were led to believe that the sludge question would be completely solved by multiple treatment through contact beds, without even the preface of tank deposition.

How futile this dream has been may be seen by numerous cases. I need only cite London, Leeds, Manchester, and Aylesbury as typical examples, where, after trying raw, or even partially settled sewage over

Note.—The Proceedings of the Section commenced with an Address by Maurice Fitzmaurice, C.M.G., M.A., M.A.I., M.Inst.C.E. (*see page* 152.)

double contact beds, it was found impossible to maintain their capacity within reasonable limits of space, time, or cost.

The gradual learning of their lesson by Dr. Clowes of London, Mr. Harding of Leeds, and the experts at Manchester, has indirectly taught another lesson to the public, viz., to distrust the optimists, and not to imagine that the bacteria will assimilate in a coke filter what they patently reject on an irrigation farm.

Mr. Harding's adverse conclusion after his exhaustive experiments in double contact filtration at Leeds is worth recalling and remembering in this connection.

"The hope that accumulations would be dissolved by rest has not been fulfilled at Leeds.

"Only by working them (the beds) at the rate of one filling of 25,000 gallons per 24 hours could the continued life of the rough filter be secured, and even then the ultimate choking seems inevitable owing to the retention in the beds of matters which have reached an irreducible condition."

So much for the tankless double contact system, at first so strongly upheld by Dibdin, but now I think, rightly regarded as dead and buried, except in rural districts, where sewage principles and Paris bonnets arrive similarly belated.

In this case it will be noted the principal factor was the choking up of the beds by the irreducible matters (both organic and inorganic) and the consequent expense in capital and renewal. A subsidiary, but by no means negligible one, was the large area necessitated to preserve capacity. In the case of Leeds, as stated by Mr. Harding in the foregoing paragraph, this would have meant twenty acre-yards for every million gallons daily flow. Such a condition would evidently be prohibitive in practice.

The doctrine of bacterial filtration without previous tank treatment or settlement having thus been proved to be economically impracticable, a step distinctly retrograde from the ultra-bacterialist point of view (but which, like many similar steps, might have been avoided by a little forethought) had to be taken. Tank settlement or treatment of some sort in tanks was advised by all the leading experimenters in terms somewhat similar to those in which the Manchester experts advised "that the sewage passing on to the bacterial beds should, by means of these tanks, be freed from suspended matter."

The choice lies between :—

(1) Tank settlement without septic action ;

(2) Tank settlement with septic action ;

(3) Tank settlement aided by chemicals.

For the purposes of comparison I shall confine myself chiefly to discussing (2) and (3); since, when the tank capacity is insufficient to admit of septic action, it is plain that more work would be thrown upon the beds, so that any economy in tank action would be balanced by a corresponding expense in filter area or renewal.

First, let us take the general results which have been obtained from the septic tank followed by contact beds or continuous filters.

(A) *The amount of solids dissolved in the tank.*—The following list gives the relative proportions of suspended solids dissolved, deposited, and ejected in the effluents from the septic tank per cent.

Places.	Period.	Dissolved.	Deposited.	Ejected.
* Manchester	May 16th, 1900, to Jan. 24th, 1901.	24·6	36·5	38·9
* Leeds	Sept. 22nd, 1892, to June 16th, 1900.	40	30	30
* Leicester		37	41	23
* Exeter		41	14	44
	Average	35·6	30·4	34·0

Similar experiments elsewhere, such as those conducted by Drs. Kenwood and Butler, show that only from 30 to 40 per cent. of the solids are digested in the tanks, and from 35 to 36 per cent. would seem to be a fair average for the proportion dissolved of the total solids.

To ascertain how much the amount deposited represents of the sludge deposited by chemical precipitants as ordinarily employed, it is necessary to travel from the region of calculation to that of fact. In proportion as chemicals are disused and septic action or mere sedimentation relied upon, so, apart from the proportion of insoluble chemicals deposited, more suspended solids, both mineral and organic, are ejected in the tank effluent. Where heavy charges of precipitants are used as at Kingston-on-Thames, the tank effluent contains no more than 1 grain of suspended matter. At other places where smaller doses are used, such as Chorley, Richmond, etc., the effluent contains from 3 to 5 grains. At London, where less than 5 grains of chemicals are added, the effluent from the tanks is said to contain about 8 grains per gallon.

We have thus every variety of grade in the amount of solids ejected,

* These figures are deduced from the various well-known Reports on the working at these places, and in the case of Exeter, from the figures given at the enquiry and quoted by Dr. Blyth, in his articles on Sewage Disposal, in the *Engineering Times*, in 1901.

and consequently somewhat similar variations in the sludge deposited, exaggerated probably by the fact that where the amount of chemicals (disregarding quality) is greatest, the sludge deposited would tend to be greatest both from the retention of the maximum quantity of suspended solids of the sewage and its deposition by the tank, together with the insoluble proportion of the chemicals.

In any case, so far as data are available, except the case of Exeter, where the sewage is admittedly weak, and the inordinate proportion of 44 per cent. of suspended solids is ejected in the effluent, we may assume that the septic process reduces the sludge deposited in the tanks by about 50 per cent. At the same time it must be noted that the method allows an equal amount to escape in the effluent, and this matter, about one half of which is mineral and the other half organic which has escaped septic decomposition, has to be dealt with on the filter-beds.

It seems to be quite overlooked by the advocates of the septic tank system that the reduction in the amount of sludge deposited in the tank is almost equivalently compensated by the extra amount of suspended solids ejected on to the filters, a considerable portion of which tends either to clog up the filter or find its way into the filtrate, or do both together.

B.—*The Sludging up of Filter Beds after Septic Action.*

Though less rapid than after settlement the sludging up of filter beds after septic action is still considerable. After receiving variously settled sewage, the following were the reductions in the capacity of the contact beds.

Place.	Capacity of Bed as Percentage of Original Capacity when empty.		Area of Bed.	Reduced to Uniform Depth of Bed.
	First fill.	After 12 months,		
Manchester	53	28	·017 acre.	3 feet.
		After 4¼ months,		
Leeds	47	22	$\frac{5}{24}$ acre.	3 feet.
		After 12 months,		
Leicester	49	20	$\frac{37}{242}$ acre.	3 feet.
		After 23 weeks,		
London (1).....	50	33·6	$\frac{80}{3}$ sq. ft.	3 feet.
		After 10 weeks,		
„ (2).....	47	29·7	10,134 sq. yds.	3 feet.
		After 32 weeks,		
„ (3).....	51	28	$\frac{26}{1089}$ acre.	3 feet.
		After 6·2 months.		
Means	49·5	28·4		

. A reduction of 21 per cent. in 6 months, or 0·8 per cent. per week of the empty bed capacity, which is equal to 1·6 per cent. per week of the *water capacity*.

An examination of the rate of sludging after distinct septic action yields in the case of Leeds and Manchester and Leicester a mean of 34 per cent. of initial water capacity in twelve months. This is about 0·65 per cent. per week.

A comparison of the rates of sludging of contact beds at Leeds, Manchester and London respectively, after the reception of crude and only partially settled sewage, gave a rate of 2·5 per cent. per week, so that we have the following scale of gradation in sludging according as the action of the beds is more and more relieved by tank action in settling or removing the suspended solids.

	Rate of sludging up of filter beds per week, as percentage of original water capacity.
1. Raw or partially settled sewage ...	2·5
2. Settled and partially septicised sewage	1·6
3. Septic tanks effluents	0·6

The actual quantities of sewage or effluent dealt with by these beds is, of course, an important factor, not merely in controlling their sludging up, but in determining:—

C.—*The area of filters required for the practical working of a septic tank scheme.*

First of all, taking contact beds and reducing the beds to a common depth of three feet, I find the following figures for the area required with double contact to secure practical working for one million gallons per day:—

Glasgow ...	4·53	acre-yards per one million gallons daily flow.
Manchester	4·26	„ „ „
Exeter ...	4·00	„ „ „
Leicester...	4·13	„ „ „
Mean ...	4·23	„ „ „

calculated on the various reports of these places.

For London, from Dr. Clowes' reports, after rapid sedimentation and on the assumption of a capacity equal to 33 per cent. of the original empty capacity, one fill per day only was achieved on filters six feet deep.

This means for double contact 7·4 acre-yards for one million gallons daily flow, and for single contact 3·7. There may be cases where, owing to the nature of the sewage, a less area is possible; but, in general, I do not think any engineer would be prepared to provide less than four acres one yard deep per million gallons daily flow where chemicals are omitted.

So far as the continuous filters are concerned, if they are reduced to the same unit of depth so that we can measure their capacity in acre-yards

or cubic yards, the rate is often such that three acre-yards are required for one million gallons flow.

At Accrington, Mr. Bootham, in his recent paper, admits a working value of 144 gallons per cubic yard per day, equal to nearly $1\frac{1}{2}$ acre-yards per million gallon flow, while the York filter which yields one of the highest I have heard of (200 gallons per cube yard), means over one acre one yard deep per million gallons flow. Continuous filters, moreover, when used after septic tanks, are open to the objection that, in order to avoid pooling and sludging up, they must be made of such coarse material as to necessitate terminal tanks to receive the solids which they transmit and disgorge in their effluents; if too fine they rapidly choke up.

PURIFICATION AFTER SEPTIC TANK.

Places.	System, O.S.=Open Septic	Rate of filtration in gallons per cubic yard. Ct.=contact, C.=continuous.	Purification percentage from raw sewage to final effluent.
Carshalton	O.S.	38 Ct.	76.7 O.*
Sutton	O.S.	Ct.	81.0 O.
Exeter	S.	Ct.	83.9 A.*
Manchester	O.S.	about 100 Ct.	about 8.20 A.
Accrington	O.S.	144 C.	91.3 A. 90.0 O.
Blackburn	S.	Ct.	97.1 A. 80.0 O.
Bristol	S.	130 C.	93.0 A. 71.0 O.
Leeds	O.S.	50 Ct.	86.0 A. 90.0 O.
Glasgow	O.S.	23 Ct.	90.6 A. 95.0 O.
Huddersfield	S.	107 Ct.	71.0 A. 71.0 O.
Leicester	O.S.	50 Ct.	83.7 A. 89.6 O.
Rochdale	O.S.	133 C.	84.2 A. 84.0 O.
West Bromwich	S.	Ct.	78.6 A. 85.9 O.
York	O.S.	210 C.	90.0 A. 84.5 O.
„	...	41 Ct.	87.6 A. 78.0 O.
Means	...	68 Ct. 154 C.	85.3 A. 82.8 O.

*O = Oxygen absorbed in 4 hours. *A = Albuminoid ammonia.

NOTE.—The first three results are taken from a report by the City Surveyor of Chichester, December, 1901, and the remainder from the report to the London County Council by Dr. Clowes, April 17th, 1902.

D.—*The chemical purification accomplished by septic tank and filter.*

The preceding table is a collection of some results with contact and continuous filtration at representative places. It does not pretend to be exhaustive, but will help to give an idea of the purification in relation to rate per cube yard.

In the case of the contact filters the figures are nearly all from second or third contacts.

Before leaving the subject of purification it may be pointed out that owing to the small purifying influence of the septic tank measured either by albuminoid ammonia or by oxygen absorbed, double contact beds are a sine qua non, where there is any necessity for maintaining a high standard.

Each contact of septic tank effluent gives only from 50-60 per cent. of purification, whereas a good chemical effluent can be purified from 60 to 70 per cent. by single contact. This, I take it, is mainly due to the greater work that has to be done by the filters in effecting hydrolysis, where a large proportion of suspended solids are contained in the effluent, than where the proportion is small.

In this connection Prof. Boyce's Report on the comparative amount of solids in the effluents from septic tanks and precipitating tanks, at Manchester (Second Report Royal Commission, page 11) is highly significant, viz. :—

Open septic tank contains	...	·7	c.c. in	600	c.c.
Cameron tank „	...	·5	„	„	
Precipitating tank „	...	·1	„	„	

and it is somewhat curious that in view of the superiority of the precipitating tank in this respect the Commission should, as Professor Boyce says, "have early introduced in their experiments the septic tank as a preliminary treatment in order that the sewage passing in the beds should be free from suspended matter."

There is apparently no suspicion of sarcasm in this remark, but one certainly feels inclined to wonder wherein the special merit of the septic tank is supposed to reside. It might save about £7,000 a year in chemicals and pressing at Manchester, a very small item for a population of 530,000, but if it rendered necessary an extra two acres per million gallons daily flow at a cost of £3,350 each, we should have a capital sum of £146,000 and an annual charge for renewal of half this at £300 an acre, together amounting to £13,300 per annum, or nearly double the assumed saving.*

The Experts recommended 92 acres for the daily flow of 20 million gallons.

* See Vol. XXII., Part II., p. 130, Journal of The Sanitary Institute.

E.—*The cost of working a Septic Tank System.*

The capital cost of new septic tank installations does not materially differ initially from those of new chemical tank systems which include pressing machinery. If anything it is higher.

As a matter of fact, a mean of the original capital cost of chemical tank systems at Manchester, Blackburn, Bury, Chorley, Heywood, Huddersfield, Hyde, Middleton, Nelson, Richmond, Salford, Stafford and Wolverhampton, as given by Mr. G. J. Fowler in his report August, 1900, to the Manchester Corporation, gives £1 0s. 10d. per head, a figure which I think the cases of Chorley and Kingston-on-Thames, where the cost was respectively 15s. and 12s. per head, shew to be unnecessarily high. The mean of new septic tank installations at Yeovil, Exeter, Barrhead and Leeds, is about 18s. per head. At the same time other lists give a figure more like £1 7s. per head, and there is little doubt that the estimates orginally made were based upon too optimistic views regarding the working of bacteria, both in the tanks and in filter beds. Moreover it is very probable that apart from the question of renewal of beds, the erection of pressing plant may be found to be necessary to deal with septic sludge, which, originally supposed to be non-existent, is now found to be a serious matter. Consequently the capital cost of a septic tank scheme may be fairly said to be at least 5s. a head more than that of a chemical.

The actual cost of working a septic system has not been correctly ascertainable in most cases, owing to its comparatively recent inception, and the fact that filter blocking and the necessity for periodical renewals are only beginning to be realized.

This latter fact is a most serious drawback. Assuming that 4 acre-yards contact filter bed are required for every million gallons flow, and that this area requires renewal about every 5 years, then with the estimate of 6s. per cube yard given by Mr. Strachan, to the Royal Commission, the cost of renewal would be about £6,000 every 5 years, or £1,200 a year. Taking the average flow to be 40 gallons a head, the cost of this item alone for a population of 25,000, with a sewage flow of 1 million gallons a day, would be 1s. a head per annum.

The cost of dealing with a septic sludge varying from 7 to 10 tons per million gallons according to the density of the sewage, the cost of filtering, superintendence, etc., will soon bring up the expenses to a figure considerably exceeding those of several chemical systems for the same population. For example, the expenses at Chorley, population 24,500, are only 1s. 2d. per head per annum.

Chemical Tank Systems.

Turning briefly to the system in which chemical precipitation is employed in the tanks, and the effluent run on to either contact or continuous filters, they differ so widely in efficiency and quality owing to the quantity and quality of chemical used, that a comparison can only be made by taking typical examples of properly worked systems. I shall, therefore, refer specially to Chorley and Kingston-on-Thames.

(A) The elimination of suspended solids about which so much fuss has been made by the votaries of septic action is effected very much better in good chemical systems. Instead of dissolving a third of the total solids and ejecting another third on to the filters, they ideally and actually, at Kingston, precipitate three-thirds to the bottom of the tanks and allow nothing up to one grain to escape on to the filters.

The disposal of such tank sludge has been the one drawback and one of the principal items of expense in chemical systems, chiefly because by the employment of insufficient and improper chemicals such as lime, worthless sludges have been produced, which, after pressing, have cost still further sums for removal.

At Chorley the sludge is utilised, both as a manure and a fuel, so as to about pay for its disposal.

At Kingston it is dried into a powder which commands a ready sale, so that the entire year's make is completely disposed of, and the expenses of both treatment and disposal recouped so as to make the cost of the system in the form of a subsidy paid by the town below those of neighbouring towns, such as Richmond, Chiswick and Teddington.

Here then we see that if the chemical system is properly worked, what is ordinarily considered a detrimental expense becomes a source of profit.

(B) The sludging up of filter beds after efficient chemical treatment and precipitation is considerably less than after septic tank treatment, as the following comparison of two salient cases will show :—

Place	Capacity on 1st date.	Capacity on 2nd date.	Loss of capacity per annum as per cent. of original water capacity.	Average rate of filtration in gallons per cube yard per 24 hours.
The Roscoe Coke Beds at Manchester	Dec. 19/95	Jan. 7/99	10·7 per annum	157
25 sq. yds. 4 ft. deep	1750	1188		
The Kingston (Native Guano Co.'s Coke Bed)	May /98	June /01		
25 sq. yds. 3 ft. deep	1400	1166	5·5 per annum	308

This last small rate at Kingston may be compared with that already given after septic tank treatment, viz. :—0·6 per cent. per week, or 34 per cent. per annum. It means 20 years instead of 3 to 4 years life for the filters.

(C) The area of filters after chemical tank, depends chiefly upon the quality of the process.

The rate at Kingston has now been six fillings a day ever since January, 1901, and the value in gallons per square yard is probably about 308 or about $1\frac{1}{2}$ million gallons per acre-yard. This means that the filtration of the Kingston tank effluent is effected upon an area of contact beds, one-sixth of that required for the septic tank.

In other cases where precipitation is employed as at Bury, Darwen, Huddersfield, Lincoln, Wolverhampton, etc., the rate varies from 1 million to $1\frac{1}{4}$ million gallons per acre-yard. This is one fourth of the area required for septic treatment.

I am omitting any comparison for continuous filters, as the evidence is so conflicting, and as the most reliable records show that when dealing with septic effluents they are only slightly more capacious per cubic yard than contact beds, and considerably more expensive. For chemical tank effluents they do not appear to be so efficient as an equal area of contact bed.

(D) The purification effected. It would be unnecessary to attempt to summarise the results from existing chemical precipitation schemes, followed by bacterial filter.

In a matter which depends largely so far as the tank is concerned, upon man instead of bacteria, the tank and therefore final purification obtainable directly depend on the quality of the process.

It will suffice to quote a few individual cases :—

Years	Filter.	Rate of filtration in gals. per cubic yard.	Purification on crude sewage tank.	Grains per gallon of Chemicals.	Purification Filter on Tank.	Total.
London..... (2 years)	6-ft. coke bed equal to double contact ...	53	29·3	4	85·6	91·2
Chorley..... (3 years)	3-ft. 3in. mixed beds..	415	62	8·3	72	89·0
Kingston ..... (3 years)	3-ft. coke..	308	83	40 to 50	66	94·3

It is easy to see how the final purification is dependent on the quality

of the tank process and the rate of filtration combined. Chorley has a tank capacity of 1,442,800 gallons for a flow of 700,000 gallons per day, Kingston has only a tank capacity of 1,200,000 gallons for a flow of 2,400,000 gallons per day. By such a combination of effective precipitation and of filtration, as shown in this latter case, the highest purification can be attained on the smallest area, a purification of 55 per cent. beyond the average attained in the septic tank system occupying six times the area.

(For discussion on this paper, see page 352.)

THE PRESENT POSITION OF THE SEWAGE PROBLEM.

By W. KAYE PARRY, M.A., M.Inst.C.E. F.R.I.B.A.
(Fellow.)

NOTHING illustrates more forcibly the complexity of the sewage problem than the history of the last six years.

At the Congress of The Sanitary Institute held in Leeds in 1887, a group of papers was read, each of which had a direct bearing upon the sewage purification question. In the discussion which followed, one of the speakers, with a pardonable touch of sarcasm, remarked that they were fortunate in getting that morning from the authors of these papers no fewer than three complete solutions of the sewage problem.

Six years of added experience have not sufficed to convince the author that the principles which he then ventured to enunciate were erroneous or contrary to the teachings of science, nor does it appear to him that they were extravagant or utopian, but he is free to admit that the methods, the use of which he advocated, have not found general acceptance.

On the same occasion Mr. Dibdin read a paper on "The Scientific Basis of Sewage Treatment." After sketching briefly the systems which had been in use prior to the introduction of the bacteriological methods, he added that in the earlier systems a clear effluent was produced with which it was possible to deal, but that the sludge still remained the *bête noire* of all those concerned in sewage disposal. He then gave an outline of the two most recent alternative methods for the purification of sewage, one of which was based upon the use of aërobic bacteria only, and the other upon the use of anaërobic organisms for the preliminary stage, followed by the utilization of aërobic bacteria for the final purification of the liquid. Into the relative merits of the two methods he did not enter, but he stated with great definiteness that both systems had proved highly satisfactory in practice, and both removed once and for all the troubles of sludge disposal.

Mr. Donald Cameron contributed at the same Congress a most interesting account of results achieved by the preliminary treatment of sewage by anaërobic bacteria in a suitably constructed tank prior to the passage of the liquid on to the bacteria beds. Mr. Cameron very wisely refrained from making prophecies, but he stated that the analyses of Messrs. Dibdin and Thudichum showed that at Exeter 81 per cent. of the total suspended matter in the sewage which passed through the tank had disappeared or been lost. In other words, that by the action of anaërobic bacteria four-fifths of the suspended solids in the sewage was digested and thus finally disposed of.

In 1898, at the Congress in Birmingham, Mr. Dibdin spoke very confidently about the economies which would result from the new system of sewage treatment. He stated that he was satisfied that the day would come when the introduction of the bacteriological system would be the means of effecting an enormous saving to the country generally. They saved in London, Mr. Dibdin added, ten or twelve millions, and there was a town not far from where they were then meeting that would probably save half a million. If they added that sum to the capitalised value of the reduced expenses of working the country would benefit enormously. In making this statement Mr. Dibdin assured his hearers he was speaking from the ratepayers' point of view. These assurances must have led his hearers to believe that not only would the working expenses attendant upon the adoption of bacteriological processes be very much less than those of the older methods of sewage treatment, but that the actual cost of constructing works suitable for the proposed methods would be very much less than the outlays necessitated by the adoption of chemical systems.

In Southampton, in 1899, the author reasserted the opinion that he had expressed in Leeds, that in every system of sewage treatment there must be some residuum which, if it were not removed, would sooner or later clog the bacteria beds, whereas if it were removed it would constitute sludge which must be handled and disposed of. Referring to the Barking experiments, where it was alleged that one acre of beds could successfully treat one million gallons of liquid per day, the author asserted that notwithstanding these confident assertions, he still believed that at least two acres of beds were necessary to treat a million gallons a day. He estimated the cost of constructing these beds under favourable circumstances at £2,000 per acre, and added that the cost would often greatly exceed this amount.

In the discussion, Mr. Thudichum asserted that under favourable

circumstances the beds could be constructed for £700 per acre, and this, he added, was fact and not theory.

At a Sessional Meeting of the Institute in 1901, Dr. Kenwood and Dr. Butler read an admirable paper on the then position of the sewage problem. In this paper the authors approached the question calmly and dispassionately, and they gave a most instructive *resumé* of the results of their joint researches. Referring to the advantages attendant upon the passage of sewage through tanks prior to its introduction into the bacteria beds, they stated that they found that by the use of such tanks from 30 to 40 per cent. of the total suspended solids could be digested.

They emphasised the importance of sufficient tank capacity, and they appeared to consider that the best results were attained when the tank capacity was sufficient to give a rest of 36 to 48 hours.

This calculation led the author to observe, in the discussion which ensued, that if engineers were to be called upon to provide tanks on such a liberal scale the works would become very costly, as storage capacity was a serious item in connection with the expenditure on sewage works, and in the end the system which did the best work in the most economical way was the one which must take first place.

The foregoing is an epitome of the views and opinions expressed by some of those who had interested themselves in the developments of the sewage problem, which were the outcome of the advent of the bacteriological systems, in so far as they related to the two aspects of the question which more particularly appealed to the practical engineer. These two aspects were (1) the extent to which the adoption of the system would overcome the sludge difficulty and (2) the economic value of such a system from the point of view of the ratepayer.

No doubt to the scientific mind the mere matter of cost is not an attractive or supremely-important consideration compared with the possibility of achieving success by the production of an effluent which would leave nothing to be desired in the eyes of the chemist or the bacteriologist. But the author's lot is cast in a poor country, where ratepayers are neither able or willing to embark upon great works except under the most strenuous compulsion, and perhaps for this reason he has been obliged to examine very carefully the grounds upon which works of magnitude for sewage treatment can reasonably be imposed upon the struggling shopkeepers and others who constitute the urban population of the smaller towns and villages in Ireland.

Hence it is that the facts and figures which have come to light during the last two years have given additional food for reflection, and must have

proved both startling and somewhat disconcerting to some of those who prophesied so confidently before their publication. Up to 1901 it would really almost seem as if the chemists and bacteriologists thought they were ushering in the Millennium and that only a little more time was needed to demonstrate, even to the mind of an ill-informed sceptic, that, whatever the future had in store, the possibility of reaction in the methods of sewage treatment was scarcely conceivable.

From this point of view the papers contributed to the Manchester Congress in 1902 by Mr. G. H. Fowler and M. J. P. Wilkinson are singularly instructive. In these papers will be found a great accumulation of valuable information, the direct results of very extended operations, both experimental and permanent, in handling the sewage of a large manufacturing centre. The new works at Manchester which are so fully and lucidly explained and illustrated in Mr. Wilkinson's paper are the outcome of these experiments. We are informed that these works will cost, in round figures, half a million of money, and they are capable of dealing, by double contact, with a daily flow of 63 million gallons and also of treating less completely on storm water filters, a further quantity equal to another 63 million gallons, making a total maximum capacity in wet weather of 126 million gallons per day.

Assuming that the suggestions made by the Local Government Board were adopted, namely, that sewage works of this character should have a capacity sufficient to enable them to treat a quantity equal to three times the dry weather flow completely by contact beds, and a further quantity equal also to three times the dry weather flow partially on storm water filters, then the Manchester works can only be considered capable of satisfactorily dealing with a volume of sewage representing a dry weather flow of 21,000,000 gallons per day. If we take the standard usually adopted by engineers, namely, 30 gallons per head per day as the average dry weather flow, then it would appear that those works are not more than sufficient for a population of seven hundred thousand persons. In other words the expenditure necessitated by similar works on the same scale for a population of one million would be almost £700,000, and the actual cost would work out at 13s. 10d. per head.

In the face of these figures, is anyone still prepared to contend that the introduction of bacteriological systems will be the means of effecting an enormous saving to the country generally?

Turning to the sludge question Mr. Fowler stated that with a tank space equal to half the daily flow of Manchester sewage it is possible to digest about 25 per cent. of the total suspended matter in the sewage.

With this figure before him is Mr. Dibdin prepared to adhere to the statement which he made at Leeds that both the aërobic and the anaërobic systems of biological treatment of sewage "remove once and for all the troubles of sludge disposal."

Have not six years' experience justified the opinion expressed on the same day in Leeds by the author that with average town sewage it was not possible to have sewage works without sewage sludge, and that whilst it might be possible to reduce the quantity of sludge to a minimum, the day was far distant when it would disappear altogether.

But fortunately we are not by any means dependent upon the reports of the Manchester experts alone for our present knowledge.

The second report of the Commissioners of the Sewage Commission is in our hands, and we can here find embodied the views of some of the distinguished men who are now engaged upon this enquiry.

Professor Boyce contributes a critical essay upon the treatment of Manchester sewage by bacteria beds which should be studied by all those who wish to master the subject. Among other statements attention may be drawn to the following:—

1. That the purification attendant upon the destruction of organic matter in the beds is effected "at the expense of a gradual reduction of capacity in the bed." If this be true, then, the life of the bed is a finite quantity, and the question of renewal of the material must sooner or later be faced.

2. That the working of the septic tank must be as carefully watched and regulated as the contact bed, or otherwise a large amount of suspended sludge passes over.

3. Professor Boyce asks and answers the question, "Can the addition of chemicals before bacterial treatment be dispensed with?" In reply to this, he points out that the report of the experts on the Manchester sewage was against the use of chemical precipitation. This report was, however, based upon the assumption that the beds would get rid of the sludge difficulty. "At Chorley," he adds, "we demonstrated by a long series of experiments how efficacious thorough chemical precipitation followed by filtration may be, and we brought to the notice of the Commission similar processes in use in Germany. It is," he adds, "a question of expense. If the septic process is used, sludge will still accumulate, and will require to be removed."

When the author in 1898, at Southampton, read a paper on "Sewage Purification without Filtration," he described the methods advocated by Dr. Adeney for treating sewage by precipitation followed by the introduc-

tion of an oxygen-carrying compound into the liquid; he submitted that excellent results had been achieved in this way as well as by the use of bacteria beds, and he added that if this be true, "the controversy will then resolve itself into a mere question of relative cost." He suggested that "it would appear to be preferable to face the cost and inconvenience of some preliminary treatment for the purpose of separating the solids day by day, rather than to run the risk of filling up the voids in the beds, as the periodical renewal of the material would entail a serious charge on the rates."

Even those who are not disposed to accept this opinion will at all events have to admit that the author in 1898, was at least as near to the truth as those who ridiculed his views as not being abreast of modern research.

Time does not admit of anything more than a cursory reference to Dr. McGowan's report, which follows that of Professor Boyce, but two of his observations are of particular interest to the Engineer.

The first is that if on a small bed the sides are sloped so that the superficial area at the top of the bed is $3\frac{1}{2}$ times greater than that at the bottom of the bed the ærating conditions must be more favourable than in a large bed where the relative areas cannot be in the same proportion. It is, perhaps, scarcely necessary to point out that beds of the size and shape which Dr. McGowan prefers would be relatively much more costly than the larger beds.

Secondly, Dr. McGowan expressed the opinion that the "life" of an open septic tank under ordinary conditions has still to be determined.

These few notes would be manifestly incomplete without some reference to Dr. Clowes' fourth report to the London County Council on the bacterial treatment of sewage. Interesting as this report must prove to all those who peruse it, perhaps the most remarkable feature in connection with it is the information which it does not contain.

Dr. Clowes was evidently desirous of eliciting facts and figures from all the leading towns, where the bacterial treatment of sewage has been installed. It would appear that information was sought from forty-seven towns and the replies are arranged in tabular form. There are two columns in the table, the headings of which are of the greatest possible interest, both to the Engineer and to the ratepayer. Namely: (1) "the actual or estimated cost of making the beds;" (2) "cost of treating sewage per million gallons."

Here at last the sanitarian hoped to find information from which some averages could be deduced. These hopes are far from being realised. It

is true that as regards the cost per acre of making the beds some very valuable figures are furnished, although only twenty-three of the towns replied to the question.

Taking an average of the whole twenty-three towns, it appears that the average cost per acre of making the beds is £4,241. This figure is even greater than that given by the author at Southampton, and emphasises the opinion which he has frequently expressed on the subject of the cost of bacterial treatment. If two acres of beds are allowed for every million gallons treated per day the interest and sinking fund on the expenditure will be over £400 per annum, and more than £1 per million gallons treated per diem. As far as can be gathered from Dr. Clowes' Tables these figures do not include the cost of the open septic tanks in the cases where they are used. When it is remembered that to get the best results this tank capacity should be at least equal to the daily flow, it becomes evident that this factor cannot be ignored, neither can the absence of any reply from twenty-four towns escape attention.

But if these figures are instructive, the absence of almost all information under the heading "Cost of treating sewage per million gallons" is still more striking. Out of the forty-seven towns only nine made any attempt to reply to the question, and the replies which were given are so incomplete and contradictory as to be valueless.

Of the nine towns, four were using chemicals for precipitating solids prior to the bacterial treatment, and the figure in each of these cases is apparently the cost of the chemical treatment and not that of the bacterial treatment. In one other town, namely Aylesbury, the cost is put down at the startling figure of £15 per million gallons treated, while Salford is put down at 16s. What is to be inferred from these contradictory replies and from the ominous silence of the thirty-eight other towns?

There can be only two answers to this question. Either the actual total cost of the bacterial treatment of sewage in these towns—which should, of course, include interest and sinking fund on the capital outlay as well as working expenses and renewals—is not known, or, if it has been ascertained, the officials whose duty it was to furnish the returns do not care to make the figures public.

Surely if such a great saving is being effected in the rates of these towns as that which Mr. Dibdin has assured us will result from the adoption of bacterial treatment, it is only fair to the rest of the community that the good news should be proclaimed.

In 1884 the Commission on Metropolitan Sewage Discharge reported

that the cost of treating sewage in tanks and by chemicals was about £1,500 per annum for each million gallons per day, or a little under one shilling per head per annum.

With all the facts and figures which are available, and in view of the conspiracy of silence among the towns that have been categorically examined on the point, will anyone yet venture to affirm that bacterial treatment, whatever be its other merits, is much more economical than the systems which preceded it? The present position of the sewage problem seems to show that although substantial progress in the quality of the effluent has been made, the best results are not obtained without great capital expenditure and great care in management, while sludge disposal, the "*bête noire* of the sanitarian," is not yet a thing of the past.

(For discussion on this paper, see page 352.*)*

THE BACTERIAL TREATMENT OF SEWAGE.

By Professor HENRY ROBINSON, M.Inst.C.E.
(Fellow.)

IT may be useful at this time to refer to some practical matters which have an important bearing on the treatment of sewage bacterially and appear to have been rather lost sight of in the last few years. The report of the State Board of Health of Massachusetts brought the subject into prominence.

In my book on "Sewerage and Sewage Disposal"* I summarized the elaborate investigations that had been carried out by that Board, and after describing the results of many experiments I refer to one which has an all-important bearing upon the matter, and was condensed by me in the following paragraphs, viz.:—

"The experiments with gravel-stones afforded the best illustration of what takes place in the purification of sewage.

"The slow movement of the liquid (even with the coarser suspended matters contained in the sewage) in thin films over the surface of the stones, in contact with air, caused 97 per cent. of the organic nitrogenous matter, a large part of which was in solution, as well as 99 per cent. of the bacteria, to be removed during a period of some months.

"There remained in the effluent only 3 per cent. of the decomposable organic matter of the sewage. The presence of bacteria was essential to produce this nitrification, which was found to be highest in all the filters from the end of April through May and June."

It appears to me that these conclusions have not been kept in view by subsequent experimenters. The introduction of the bacterial system into this country was *not* based on the continuous passage of sewage through interstices in the presence of air, but was largely based upon experiments

* Spon, London.

conducted by Mr. Dibdin for the London County Council, where the sewage was passed through "contact beds" in which interstices are alternately filled and emptied.

The Council have continued these experiments, and the results have been published in Reports. These hardly elucidate matters, inasmuch as the conclusions do not appear to be consistent. The third Report contains data and opinions of Professor Clowes and Dr. Houston, from which the following passages may be quoted :—

Biological Conclusions.

"Although the total number of bacteria, the number of spores of aërobic bacteria, the number of liquifying microbes, the number of B. coli and of spores of B. enteriditis sporogenes was, on an average, less in the effluents from the coke beds than in the corresponding samples of crude sewage, the reductions were not well marked, and in some cases the effluent contained more micro-organisms than the sewage before treatment. Thus, while the chemical results were always satisfactory, the bacteriological results were usually quite the reverse, because the microbes producing the chemical changes passed through the coke beds in practically unaltered numbers."

"In view of these results, only one conclusion seems possible, namely, that however satisfactory the process may be from the chemical and practical points of view, the effluents from the bacterial beds cannot be reasonably assumed to be more safe in their possible relation to disease than raw sewage slightly diluted, but otherwise unaltered in its bacterial composition."

Another extract is as follows :—

"Where an effluent is turned into a stream to be used for drinking purposes, the bacteriological results are manifestly of more importance than the chemical; but when, as in the present case, the river is not a potable one, and is already polluted, the converse probably holds good; *i.e.*, the chemical state of the effluent is of primary, and the biological of secondary importance. In the first case the chief object is to guard against disease, and in the second case the main consideration is to avoid fouling the river with prutrescible matters to such an extent as to constitute a grave public nuisance."

In a paper read on the 25th June last, before the Association of Municipal and County Engineers, Professor Clowes states as follows :—"It was concluded from the experience obtained from these experiments (*i.e.*, those carried out for the County Council), that, providing a settling tank

and coke-bed bacterial plant is properly constructed and properly worked, a very uniform and satisfactory purification of the sewage is effected, a very large proportion of the suspended matter is disposed of; and further, that the process is one which requires little cost in maintenance.

"A purely domestic sewage, when treated by these processes, was found to yield no sludge, and the process was found to dispose, to a great extent, of the bacteria, since the effluent contained only a small percentage of the number originally present in the sewage."

A consideration of the foregoing quotations will hardly advance matters or assist in the solution of the sewage question.

It may be useful to refer to what the Royal Commission on Sewage have recorded in the Report of 1901.

"We are impressed with the great importance of the bacteriological questions which have arisen in the course of our Inquiry, but we do not, at present, feel justified in putting forward any conclusions concerning them.

"We may however, even at this stage point out, that as a result of a large number of examinations of effluents from sewage farms, and from artificial processes, we find that while in the case of effluents from land of a kind suitable for the purification of sewage, there are fewer micro-organisms than in the effluents from most artificial processes, yet both classes of effluents usually contain large numbers of organisms, many of which appear to be of intestinal derivation, and some of which are of a kind liable, under certain circumstances at least, to give rise to disease."

In spite of the foregoing conclusions the fear that pathogenic bacilli will pass through bacteria beds may be considered to be groundless provided the beds are worked on proper lines and not in the form of contact beds. I have experience of the satisfactory results which can be obtained by treating sewage in bacteria beds by continuous filtration through interstices in the presence of air on the lines indicated at the commencement of this Paper by the Massachusetts Board.

A recent examination by Dr. Thresh of an effluent produced by passing crude sewage (after preliminary sedimentation) through two aërobic beds gave results which he describes thus:—

"Nitrification was even more active than on the first occasion, and again practically the whole of the ammoniacal matter has disappeared. The sewage in the second series of experiments contained a rather large proportion of tanning effluent. Notwithstanding this, the final effluent was fully oxygenated, and the nitrification and purification was exceedingly satisfactory. Chemically, purification cannot be carried much further, and

an effluent of this character, even if discharged into our sluggish Essex stream in summer, could not cause any nuisance; in fact, the effluent is purer than the waters of many of our rivers."

In comparing the aërobic with the "contact" bed system the following points deserve consideration, viz. :—

The Local Government Board have required three times the dry weather flow to be treated as sewage proper, and that the cycle of operations in contact beds shall be eight hours. This condition necessitates contact beds being made sufficiently large to deal with three times the dry weather flow on eight hour cycles. On the other hand, the Local Government Board allow aërobic beds to work at a greater rate during the increased flow, thereby saving a large area of bed as compared with the contact method. Another advantage is that the treatment of the sewage aërobically is assured, whereas in the contact beds it is neither one thing or the other.

Public money could be usefully expended in experiments directed to determining the best materials and depth for both classes of bacteria beds, also the most effective rates of working. A series of contact beds and of continuous trickling beds worked side by side under similiar conditions of flow would give results of the greatest service. Other experiments of practical value could be suggested. If such were carried out valuable information would be afforded at comparatively small cost for the guidance of those who have to advise as to sewage disposal.

The Local Government Board would also have data to assist them in considering the conflicting schemes which now come before them.

It is to be hoped that the Royal Commissioners, will, before concluding their labours, afford those who are responsible for advising in regard to sewage treatment, some practical data that can be utilised, and will advance knowledge.

[*This discussion applies also to the papers by* Douglas Archibald *and* W. Kaye Parry.]

Dr. Rideal (London) said that sanitarians had arrived at a position in which they could say definitely that there were two processes in preliminary sewage treatment. It was recognised now that there must be a first and a second process of treatment, and the discussion that day was as to the nature of the first process. They learnt much from Mr. Archibald's paper. The first process might be either chemical or septic, and Mr. Archibald's argument was in favour

of the chemical treatment with a good heavy dose of chemicals. Mr. Parry's paper had drawn special attention to the comparative cost, and had discussed the question of whether the second process could be more economically conducted by a continuous filter or by bacteria beds. The readers of both papers were agreed that to expect the double contact bed to do everything was absurd. The advocates of the contact bed were not present that day, but one recollected the early experiments under the advice of Mr. Dibdin, when it was confidently believed that the bacteria of the contact bed would eat up the sludge. That expectation had failed, and there were many beds which had shown a great falling off in capacity owing to the fact that they did not eat up the sludge. It was therefore necessary to have some preliminary treatment for the removal of the solids before the purification of the effluent by oxidation. To expect the contact bed to do everything was like a manufacturer attempting to make beer and vinegar in the same vat. At the Leeds conference he ventured to predict that it would be found that an anaërobic process was essential to success, and what had been read to-day confirmed the opinion. Mr. Archibald still preferred a chemical treatment, at what he (Dr. Rideal) considered an enormous cost. The contact bed, moreover, was quite as unsuitable for the second process as it was for the first. When would it be recognised that this second process, this souring, required air? Ordinary sewage containing from five to ten parts of free ammonia requires a volume of air at least equal to its own volume to convert the ammonia into nitric acid. For this purpose he thought the continuous filter was far preferable to the contact bed. It was much cheaper because it did not require substantial walls. The flow of a continuous filter was much faster, too, than was allowed by the Local Government Board's requirements for a contact bed. A continuous filter can be easily worked up to 250 or 500 gallons per square yard and still give satisfactory results. So that from several points of view the continuous filter is the more economical method. A better flow is obtained and the cost of construction is not so great. Professor Robinson had referred to the data and opinion of Professor Clowes and Dr. Houston on the purification of sewage to a drinking water standard. It seemed to him that in such works the engineer must be a physiologist, and must test the water every few hours with guinea pigs to see if it killed the pigs. That was, however, not really the problem which faced engineers, who had to make an effluent satisfactory, perhaps, for bathing purposes. He considered that it was the duty of every town to see that it was provided with a proper supply of pure water. It was not the duty of the town, which might be five miles up the river, to produce a satisfactory water supply for the town lower down the river.

Dr. Gilbert Fowler (Manchester) said he was afraid he should find himself in conflict with some of the previous speakers. They had been told that the anaërobic action was essential to a proper purification system. With household sewage he believed that it was better, but he for one would not venture to say

that any one thing was essential. He believed that the more the sewage problem was studied the less they would be inclined to lay down general rules as to what was essential. He agreed also that they would do well to know more of the work done outside England. He was very glad that the remarks as to the work of the State Board of Health of Massachusetts had been made. Those experiments were in danger of being forgotten; but they were made under conditions very different from those now obtaining. The filter was of very fine material, and that was a point which should be noted. Taking the first point which had been put forward in the discussion, that an anaërobic treatment was necessary, the experiments of Dr. Dunbar at Hamburg, which had been carried with the thoroughness which a German scientist usually put into work, showed that thoroughly good purification could be detained by means of contact beds which were only to some extent anaërobic and to a large extent aërobic. Close at home they had the Leeds experiments with raw sewage, which by continuous filters, without any preliminary anaërobic treatment whatever, but with final filtration over sand, gave an excellent effluent. Here one had a process where no kind of preliminary anaërobic treatment was made use of. But nowhere had work been done upon a scale sufficient to justify a comparison of the two systems. Very exaggerated notions were prevalent as to the cost of washing contact beds. He had heard of septic tanks in small districts which had gone very well for a few years, and then had had to be cleared out. Unless one had suitable apparatus it was not the simplest work to clean out a tank after three years or so. He would like to see more consideration given to the question whether it was the simpler thing to clean out such a tank than to take up a contact bed and wash it and remove the small amount of inoffensive humus that would be found there. In Dr. Dunbar's experiments the cost was given and the amount of residue found was small, which could not be said of the septic tank under all conditions. Sanitarians did not yet know enough of the intimate reactions which went forward in continuous filters and contact beds respectively to say always which were to be preferred, for this reason, that the purification of sewage, was, he was convinced, not a simple oxidation process. It was much more complex, and the denitrification changes were quite as important in some cases as the nitrification change, and there were other than nitrogenous impurities which they could not leave in the effluent. At Accrington was one of the best examples, for there was a sewage of highly nitrogenous character, and from it was obtained an effluent with much nitrate, but before this was really satisfactory a final purification had to be given, involving denitrification. In regard to the cost of constructing these beds, they had had some experience in Manchester. The continuous filters must be of hard, large, and open material. If one took an ordinary cinder-tip as the basis of supply, one wanted thousands of tons of material, for in the ordinary cinder-tip the percentage of large material suitable for those filters was very small. The difference of cost was, he thought, very considerable in this respect between contact beds and continuous filters.

Mr. J. D. Watson (Birmingham) said that one or two points had been raised in the discussion upon which he thought he could give some information. A great deal had been said about the relative merits of lime sedimentation, chemical treatment, and septic action. The Drainage Board which he represented were responsible for the treatment of the sewage of a large district, including Birmingham. At Saltley, where the bulk of the sewage was treated, £4,500 was spent on lime treatment in 1900. The dry-weather flow thus treated amounted to 22 million gallons per day, and the average results obtained for the year in parts per hundred thousand were as follows:—

Dissolved solids	..	133·2
Suspended solids	..	4·2
Total solids	..	137·4

The crude sewage was as follows:—

Dissolved solids	..	127·7
Suspended solids	..	72·7
Total solids	..	200·4

showing 31·4 per cent. of total solids removed after sedimentation assisted by the addition of 9 grains of lime to the gallon of sewage. In 1901, when no lime was used and about one half of the tank area had been converted into septic tanks, the results were as follows:—

Dissolved solids	..	115·4
Suspended solids	..	24·5
Total solids	..	139·9

The crude sewage as it entered the tanks for 1900 was as follows:—

Dissolved solids	..	129·1
Suspended solids	..	67·6
Total solids	..	196·7

showing 28·9 per cent. of total solids removed by mechanical precipitation plus septic action. In 1902, under similar conditions to those obtaining in 1901, the effluent leaving the septic tanks showed the following average for the year:—

Dissolved solids	..	117·9
Suspended solids	..	27·4
Total solids	..	145·3

The crude sewage for 1902 was as follows:—

Dissolved solids	..	127·6
Suspended solids	..	68·6
Total Solids	..	196·2

About the beginning of 1903 the system was altered by the addition of pumping and sludge-lifting machinery, which enabled them to clean out the detritus

chambers and sedimentation tanks much more quickly. Instead of an interval of six or seven weeks elapsing before each tank was cleaned out, they were now capable of doing this work once a week, with the practical result of increasing the capacity of each tank by the reduction of the sludge which it contained. The effluent from the septic tanks for 1903 had so far shown an average of:—

Dissolved solids	..	104·1
Suspended solids	..	14·7
Total solids	..	118·8

The analysis of the crude sewage showed:—

Dissolved solids	..	126·5
Suspended solids	..	81·9
Total solids	..	208·4

or a percentage of total solids removed from the sewage in 1903 of 43 per cent. The benefits of the septic tanks were, therefore, not so apparent in 1903 as in 1901 and 1902, but the amount of both organic and inorganic matter disposed of before the sewage was allowed to flow on to land had been very much reduced without increased cost, and without increased nuisance. He thought he saw his way to retain the benefits obtained from the septic tanks 1901 and 1902 without reducing the frequency of the cleansing operations in the large sedimentation tanks. He was quite convinced that too little attention had been paid to the construction and management of sedimentation tanks. During the past few years progress had been retarded by a hope which had proved to be a delusion, namely, that septic action would entirely rid them of sludge. Advertisements of that kind were a delusion and a snare. They must look facts in the face and deal with them accordingly. He agreed with Mr. Fowler that they should be very careful to keep an open mind on matters of sewage disposal. While he had found the greatest possible benefit in septicising the whole of the dry-weather flow of his district, he was bound to admit that in certain cases results had been obtained from the application of crude sewage to land which had not been excelled by the application of septic sewage. He thought that there could be no doubt about the benefits which had accrued at his works by the abandonment of lime treatment. In lime and working expenses nearly £5,000 per annum had been saved, and it had been proved that the application of chemicals precipitated the micro-organisms which nature had provided for the ultimate purification of the organic matter contained in the sewage. He wished to support Dr. Rideal's remarks about continuous filters—or, as he preferred to call them, percolating beds. The construction of these beds in the first instance was cheaper than contact beds, and in the second place they were capable of purifying a larger quantity of sewage, but it had to be remembered that percolating beds could not always be constructed without resorting to pumping. Where land levels rendered pumping unnecessary, the percolating bed was the more satisfactory method of producing a well-oxidized effluent.

Mr. James Robinson (County Health Inspector, Durham) said that for the last nine years he had been engaged in sewage disposal work, and for several years he had regularly inspected the whole of the most important sewage works in the county (about eighty in number) at least four times a year. His experience was that the double contact system gave the best results of any bacterial system adopted in the county, and was thoroughly to be relied upon to give a uniformly satisfactory effluent with weak or strong sewages, but a much longer time of contact was required for the latter; and he was convinced that when an authority adopted that system, with at least proper sedimentation tanks, the money would be well spent. At Southmoor, where the filtrate has often shown 95 per cent. of purification, the raw sewage is gathered into a storage tank which is emptied two or three times in twenty-four hours, and allows of a considerable amount of sedimentation taking place. At Esh Winning the sewage is continually flowing through an open settling tank, whilst at Sacristan the sewage continually flows through two covered tanks on to the rough filters. Both give excellent results, but in the latter case, until air was admitted through the manhole covers of the second tank, a good effluent was not obtained, nor did any scum form in the tank. His experience led him to advise all who adopted continuous streaming or trickling filters for the treatment of other than very weak sewages, to have some secondary treatment if they wished to obtain a uniformly satisfactory effluent. This is what he would be reporting to his committee on the following Wednesday. In addition to the bacterial systems they had a variety of others in operation. In some small places the sewage is treated on grass plots without tank treatment, and effluents like crystal were generally obtained, but no particular system could be adopted at all places, as the requirements and peculiarities of each varied so much.

Mr. A. J. Martin (Westminster) said his object in interposing in the discussion was to give a little assistance to Mr. Archibald. That gentlemen in his paper had said that his object in preparing it was not so much to give his own opinions as to lay facts before the Conference. He had given a good deal of information, and he had treated the subject from the point of view which dominated a question of that kind—the question, namely, of cost. Mr. Archibald had stated that the cost of works for bacterial treatment was greater than that of works for chemical treatment. That comparison was based upon an assumed average cost of 18s. or £1 per head for a complete septic tank installation, and 12s. or 15s. per head for chemical precipitation works. These figures were, he contended, quite misleading and inaccurate. The united cost of the installations at Exeter, Yeovil, and Barrhead, which served a total population of 71,000, was £36,500. It would be seen that the average cost of these works was not 18s. per head as stated, but about 10s. only. Then with regard to the annual cost of maintenance, Mr. Parry complained that, though inquiries had been sent by Dr. Clowes to the engineers of works on the bacterial principle, they had not been

answered, and that very few engineers had given any information on this point. Mr. Parry drew the conclusion that engineers dare not publish the cost of maintaining their works. But everyone knew that for the first four or five years the cost of maintenance on the bacteria system was practically nil; in fact he knew a case where the cost of a year's working was a £1 less than nil. The explanation was that there was a small piece of land surrounding the works, and the rent of that piece of land, less the whole of the working expenses, amounted to £1 per annum. But it would be nonsense to put forward such figures as representing the cost of maintaining the system over a term of years, and he contended that engineers were justified in withholding such figures from the Commission when their works had not been in operation a sufficient length of time to furnish a fair criterion of the cost of working. It was not only justifiable, it was a duty, that such figures should not be put forward as furnishing any evidence of the real cost. The main point made by Mr. Archibald in favour of chemical precipitation was the extent to which he got rid of suspended matter. He quoted certain figures, giving the amount of suspended solids dissolved, deposited and ejected in the effluents from the septic tank. In this table he included the works at Belleisle, Exeter, and most people would understand from his reference that this was a modern up-to-date septic tank installation. But it was nothing of the kind: it was only the first crude attempt. He also referred to Leeds, where, instead of using the means provided for freeing the effluent from suspended matter, they had sent as much as possible in to the filters. On the improved lines on which they now worked, the effluent produced would bear comparison as regards the amount of suspended solids, he would not say with the excellent chemically obtained results at Kingston, but with the ordinary effluent from chemical precipitation as ordinarily practised. As to the delusion, of which so much had been said, that sludge was annihilated, Mr. Cameron and he himself had in every paper which they had read on the subject pointed out that, though most of the sludge was got rid of, there was an irreducible minimum which could not be got rid of in the tanks, but must be otherwise disposed of. It was therefore absurd that at this time of day they should have people discovering that the sludge was not absolutely got rid of in a septic tank. There was one thing in Mr. Archibald's paper which, he feared, he must have misunderstood, or Mr. Archibald had not done himself justice. In the early part of his remarks he said, as he (the speaker) understood, that in dealing with the bacteria system of treatment, one must take the worst cases as well as the best, and that one had to judge the system by the average. That was fair enough. But when speaking of chemical precipitation, he said that this method had to be judged by its best results. He (the speaker) maintained that this was hardly a fair basis of comparison. He entirely agreed with what Mr. Fowler said a few minutes previously as to the work of a contact bed not being a plain straightforward oxidation. There were processes involved which baffled investigation, and the amount of action which took place in contact beds could

not be accounted for by the hypothesis that the amount of work done depended upon the quantity of oxygen dissolved in the liquid, for in actual practise the amount of work done exceeded that which could be accounted for upon that basis. He had before him the results of exhaustive analyses showing that single contact beds dealing with septic tank effluent effected a purification of from 70 to 85 per cent., the total purification effected by the septic tank and the one contact being from 86 to 93 per cent.

J. E. Parker (Newcastle-on-Tyne) said that he had had considerable experience in the several systems of sewage disposal and the opinion he had come to was that the continuous system presented the fewest objections. When an engineer came before a committee the question generally asked was, not what system gave the most ideally perfect effluent, but, what is the cheapest efficient system you can recommend. The matter of cost must be taken into serious consideration, and it was necessary to compare one system with another largely on the basis of cost. He found that even in districts where coke breeze was a bye-product that the continuous filter could be laid down cheaper with clinker than any contact bed with coke breeze in the proportion as seven is to ten. Having laid down both systems and periodically examined their behaviour when in work he came to the conclusion that the continuous filter gave on the whole the best results at the least possible cost, both as regards construction and maintenance. The continuous filter was to his mind the simplest thing that could be got to do the work. He used the term "continuous filter," though the words were somewhat of a misnomer, because the action, in order to obtain the best results, should be intermittent, and thus allow the gelatinous matter, which forms at times on the upper surfaces of the clinker, to become dried into an impalpable powder, instead of choking the top of the bed. A certain amount of suspended matter is carried out from the body of the filter with the effluent, but this is inert and unobjectionable and can be arrested in a lagoon, and thus a satisfactory result could be obtained at a minimum of cost.

Dr. A. P. Evans (Warwickshire County Council) said that the chemical treatment was said to be more effective, but while it relieved the immediate neighbourhood of smells, it left their stinks for their neighbours lower down the stream into which the effluent flowed. It did not remove decomposable matter, but simply postponed the decomposition taking place for some hours; this, in his opinion, was exceedingly objectionable. It only clarified the sewage, and did nothing to resolve it into its natural elements. Chemical treatment was said to be cheaper, but he believed there had not been time to judge accurately which was the cheaper and more effectual method. He knew a system which was nearly perfect, where the tanks are so arranged that they work automatically, and the effluent passes through a tank containing fish, and the fish have lived in it for some months, and are quite healthy. The effluent was perfectly main-

tained, and this could not be done by any chemical treatment. He believed that the chemical treatment of sewage would die a natural death.

Mr. Douglas Archibald (London), replying on the discussion, said that he would like to reply to some remarks of Mr. Martin. He was obliged to Mr. Martin for kindly supplementing his data. What they all wanted to know was the truth. In regard to the cost of the septic tanks, the question was in a preliminary stage. He had worked out the figures given in his paper very carefully from the data at his disposal. If the system could be carried out for less money than he had mentioned, the advantage lay with those people who advocated the system. With regard to the statement that he quoted the worst or the average cases of bacterial treatment and the best of the chemical treatment, he must defend his position. In dealing with the bacterial method, man could not control the result in the same way as he could when using chemicals. Some people called it a chemical method when they used two or three grains to to the gallon. Some used thirty or forty grains. As man could fully control the result by the amount of chemicals used, he thought he was entitled to say that they could only measure the chemical treatment by the best standard. In the case of the bacterial method, since the processes were out of the control of human beings, they could only take the average result. Therefore he said that the comparison which he had made was fair. He would not carry it too far. It would be useless to quote the London system as chemical treatment when it was shown that in some cases the tank effluent was really worse than the original sewage after the chemicals had been put in. That was not proper chemical treatment. The purification ought, *ceteris paribus*, to rise in proportion to the amount of chemicals put in. Dr. Carter Bell had plainly shewn that in proportion as more and more sulphate of alumina was put in, the better became the effluent. In regard to Dr. Rideal's remark that the amount of chemicals employed added a great deal to the cost, he would only say that such cost might be advantageously recouped by making the sludge into fuel or manure. In regard to the quoted capitals for works, he defended the figures he had given in his paper. The filter area was very much smaller where a good chemical precipitant scheme was at work. It might be, indeed, one sixth of the area employed with the septic system. Beyond the economy of space there was another point. In regard to continuous filters, Dr. Rideal said that the rate per square yard was much higher than with contact beds. Continuous filters were generally made ten feet deep. But in many cases that was no economy, because that would only mean in general so much extra pumping lift, so that the contact bed would be preferable. He did not think that in any fair comparison there was much to be said in favour of the continuous filter. Mr. Watson, of Birmingham, said that with precipitants the organism which would do the work was precipitated to the bottom, and the subsequent process was not so well carried out in consequence. So far as he could see, the purification after a good

chemical process was much higher than after a good septic tank. Though some good organisms might be precipitated to the bottom, he thought a great many more evil ones were also precipitated. As a fact, in the case he had specially in mind the tank effluent after one filtration gave a purification as high as 94 per cent. Some persons talked as if he proposed chemical treatment followed by nothing. He did not believe in this. Chemical treatment ought to be merely a preliminary process, and to be supplemented in most cases by filtration. It was only when treated in this way that sewage yielded a non-putrefactive effluent. Everyone now looked upon the chemical treatment as merely a prelude, but a very effective prelude, to further treatment.

Mr. Kaye Parry (Dublin), who also replied, said he thought the papers had answered the purpose for which they were written, namely, to elicit a useful exchange of views. As regards preliminary chemical treatment, it amounted to this, that whatever system was adopted, the solids must be got rid of in some way. Whatever may be now said on this subject, five or six years ago they were told that, hereafter, by utilizing bacterial agencies, there would be no such difficulty to overcome. The question now was whether the solids could be best separated by utilizing some precipitant which was not a germicide, or whether the separation could be more easily and economically effected in some other way. He had an open mind on this point, but he was by no means sure that it would not prove to be worth while to carry out this preliminary separation by the use of some chemical. The cost of pumping, in connection with bacterial treatment, was a factor which must not be overlooked. At Hampton, where a very complete bacterial installation was carried out with triple contact beds, and where an excellent effluent had been produced, the sewage had to be lifted about twelve feet, to obtain the head necessary to fill and empty the three series of beds. The cost of pumping, which is often necessitated by the adoption of double or triple contact, must, therefore, be reckoned when computing the working expenses of bacterial treatment.

A HOSPITAL WARD.

SOME DETAILS AND THEIR PRINCIPLES RECALLED.

By ALFRED SAXON SNELL, F.R.I.B.A.

(Fellow.)

I DO not propose to advance new theories, nor lay down fresh principles which should govern the details of hospital ward design and construction; but rather to recall one or two fairly old principles which sometimes seem in danger of being forgotten, or at least not acted upon with the thoroughness which is necessary to give them entire fairplay. There is a danger too, that in flying to new ideas, we may forget the lessons of the older ones, and thereby court failures; failures which are forthwith placed to the credit of the newer by those who judge by appearances only, or take short views of these matters.

There are several instances known, in the case of new wards constructed upon the latest principles, of failures which have been absent from the older and quite out-of-date buildings, and the reasons have been, in the cases with which I am personally acquainted, not far to seek. The old wards were known to be dangerously unclean, and special precautions were therefore taken to counteract this condition. The new wards were so very bright and clean, that anything but perfunctory cleaning was thought scarcely necessary. In the old wards, the windows were kept open, and the very walls, innocent of plaster, were porous enough to be an assistance to ventilation. In the new, it appeared that the provision of air inlets in the walls was thought to obviate the necessity of opening the windows.

Another example of this neglect of well-worn principles occurs to me, although it is not directly connected with a hospital ward. The drainage of a certain building was relaid upon modern principles with manholes at every branch and change of direction. The old drains were well flushed periodically, and thus kept fairly clean. The new drains were supposed to act for ever without such assistance. Five years after, when super-

intending some repairs, &c., at the building, I made a general examination of the system, and was compelled to use a crowbar to open up the covers of the manholes, which had never been opened since the drains were first laid. The building owner in this case had not realized that manholes were constructed for more easy access to, and inspection of, the new drains than was possible with the old.

One other example—and this was in connection with a ward. The whole of the inlet ventilators were expensively constructed with pipes glazed internally. On revisiting the hospital a year later, I found these flues black with dirt. No one ever thought of cleaning them.

Are not we apt at times to forget the principles upon which we design certain details? It is an accepted principle, for instance, that all angles, internal and external, should be well rounded. Yet not many years ago an architect drew the attention of a class of students to the hollowed skirting between the walls and floors of his wards; and went on to point out an arrangement he had devised for preventing the beds being pushed against the walls. This consisted of a square fillet nailed to the floor within half an inch of the skirting—*i.e.*, he had carefully done away with *one* internal square angle to the floor and added *two*.

I have heard, too, of air inlets constructed as I have described above, being closed at one end with a fixed grating, which effectually prevented any cleaning.

After all, the great principles to be kept in view in designing the details of a hospital ward are few and simple, and one of them—not the least important—is the avoidance of all sharp internal angles, deep-cut mouldings, and other not easily-cleaned lodgments for dust and dirt, those harbours of disease germs and sources of pollution to the air of the ward. It will be sufficient, in so short a paper as this, to deal mainly with this principle.

Floors.

It may be taken for granted that whatever difference of opinion there may be with respect to the walls, we shall all be agreed that the floor of a ward should be laid on a solid foundation, and that the surface should be as impervious as it is possible to make it. Also that it should be smooth and free from holes or crevices likely to retain dirt or dust. For this reason no one thinks nowadays of using plain jointed soft wood floors, because in addition to being absorbent, the material is bound in shrinking to form any number of crevices for the secretion of dirt and dust. Floor sweepings well wetted and impregnated with soap make a horrible compound.

Modern floors are of several kinds, which vary according to the fancy of the particular architect or the managers of the building. They comprise the following, viz. :—Hard wood block floors, hard wood tongued boards laid in narrow widths, asphalte, terrazzo, patent composition floors such as Euboeolith, Papyrolith, etc.

The hard wood floors are most frequently made of oak or teak. Hitherto I have myself adopted kiln-dried maple in very narrow widths. In addition to being an exceedingly hard and unwearable floor, its light colour shows up dust much more easily than dark woods, and this, to my mind, is an important detail. It would seem to be very desirable that dirt should always proclaim itself; but those who are immediately responsible for the cleanliness of the floors are, it is to be feared, not always of that opinion.

The most usual finishing to wood floors is beeswax and turpentine highly polished. I believe that if this is regularly wiped over with a cloth, and as regularly polished, it is a very good surface; though no doubt it is desirable to have the surface entirely cleaned off and renewed at intervals. The preparation called "Ronuk" is equally good.

Terrazzo floors are much advocated on account of their supposed impermeability. I do not think them quite so impermeable as they are supposed to be. After all, the main part of the material is cement, and it is well known that cement is fairly absorbent and marble chips are scarcely less so. Indeed the comparative impermeability of this floor is due to the high polish it receives when first laid, and that is very soon worn off. Perhaps it is best treated by being polished with beeswax as for wood floors. Even so, it is very hard to the feet, and the mottled colour too easily conceals dirt.

Asphalte is, no doubt, the most impervious of floor materials, but it is of a dark, uneven, and bad colour, and is therefore seldom used.

My experience of patent composition floors has not hitherto been so fortunate as to enable me to commend them highly. They have some undoubted virtues, and the material is more impervious, and less subject to the action of acids than any I know. Unless very carefully laid, they appear to be liable to swell and crack. The material can be coloured, and when polished the surface is generally excellent.

Skirtings.

The skirting (if it can be so called) to the floors should be rounded so as to form a good hollow. The most usual radius is from $2\frac{1}{2}$ in. to 3 in. Latterly I have used $1\frac{1}{4}$ in. only, which is quite sufficient for its purpose,

and can be carried round projections more easily than is possible with the larger radius. All that appears to be necessary is to have such an angle as will permit of the whole surface being easily and rapidly cleaned, and prevent stagnation of air. It is best formed of the same material as the floor. Hollowed glazed bricks have been used, but there are too many joints, and the edges of the bricks are not generally even.

WALL SURFACES.

There are practically two opposite principles which govern the material of which the wall surfaces should be composed, and these are derived from different views on that much-vexed subject, ventilation. It would be rather trenching upon this subject, which is large enough for separate treatment, to attempt to discuss here whether the walls should be porous or not.

It is safe, however, to assert that at the present time, for hospital wards at least, impervious walls are mostly in vogue. If we adopt this principle, the next important consideration is that the surface of the internal faces should be easily cleaned and kept clear and free from dust. In some modern treatment of walls we have, I think, somewhat overlooked this principle, although at first sight it appears to have been carefully studied. I refer to the growing practice of lining the ward walls with tiles. The use of tiles has no doubt given us a more impervious and even surface over a large area, but it is discounted by the numerous joints which no care nor skill in the fixing can make perfectly smooth. The ideal finish would no doubt be an unbroken and polished surface such as obtains on tiles, affording no ledges for the lodgment of dust; but this has been fairly well achieved by the use of enamel paint upon hard trowelled cement surfaces.

It is scarcely possible to obtain a more generally smooth surface than trowelled cement—Keene's or Sirapite, and other hard cements. These can be brought to a polished surface. It is, however, difficult, if not impossible, to obtain a really even colour, and painting is therefore necessary. Although enamel paint can be used with decorative effect, pictures would still be required to enliven the walls, and the ordinary framed picture is a veritable dust trap. Therein tiled surfaces have the advantage of painted walls, as they can be decorated with permanent pictures painted on the surface. It would of course be too costly to renew pictures every time the walls required to be repainted.

It would be possible to cover permanent wall paintings with glass let in flush with the wall surface; and I am not sure that this has not been done.

Ceilings.

There can be no question that ceilings should be non-porous, and they are best painted.

Windows.

As to the best form of window for a hospital ward, there does not appear to be any general agreement. The most usual is the ordinary sash window with a hopper above opening into the ward, with spandril sides to prevent down draught. Its form and construction involve the many angles, crevices and hidden voids which in other parts of the ward we strive so much to avoid. Casement windows with solid frames at least are not open to this objection, though no doubt their advantages in other directions may be questioned.

At Willesden Parish Infirmary I have used casement windows brought down to within 12 inches of the floor, and with hoppers next the ceiling. The casements open inwards, and thus form a protection for the bed. It is also possible by opening the windows to their fullest extent to flood the wards with air much more effectually than is possible with sashes.

At Charing Cross Hospital, I am adopting a form somewhat similar to what I believe is known as the "Middlesex" window, (owing to the alleged fact that it was first used at that hospital). There are five sashes of equal size in the height of the window, all of which (excepting the lowest) are hung on centres and controlled by one rod and lever. (In the "Middlesex" window the sashes are hung on the bottom rail.) The sashes close one upon another, and there are therefore no transoms. The lowest sash is separately hung on the bottom rail. It is obvious that a window so constructed can be opened to a much larger extent than is possible with the ordinary sash window. I should add that all except the controlling lever of the opening apparatus is fixed on the *outside* of the window.

If it is possible to fix the glass quite flush with the inner surface of the sashes, a great advance will be made.

Doors.

Nothing much can be said with respect to doors in a ward. They should be made wide enough to allow of the passage of a bed. It is desirable that the upper panels should be glazed with clear glass, and that for a reason to which I shall refer later on.

The whole question of the material for joinery might be considered here. Hard wood throughout is generally adopted, where the question of

cost is not vital, hard wood oiled or French polished. Its comparative freedom from material shrinkage, and its harder or less absorbent surface, are great advantages. Nevertheless, I think that soft wood covered with enamel paint is not much, if at all, inferior.

I am hoping in time to obtain what may be called solid joinery, *i.e.*, built up without panels with the inevitable sharp internal angles which can only be kept clean at the cost of great labour. Of course, it is possible to have solid or flush panels, but shrinkage soon shows up the joints, which then become dust traps impossible to clean.

There are some Canadian doors now made of which the principle of construction could, no doubt, be applied so as to successfully overcome this difficulty. They are made up of quite small sections of wood very closely fitted together, and sheathed with hard wood beautifully dove-tailed to the whole, pressed and almost welded together by hydraulic pressure. At present they are made to imitate the ordinary panelled door; but one is being made for me now (as an experiment) of *solid* soft wood, sheathed all round in oak.

FURNITURE.

It is in the furniture and fittings of wards (for which the Architects are not generally responsible) that there is a general falling away from the principles of construction we are considering; although I am bound to add that some very notable improvements have been made of late years in the construction of chairs, tables and bedside lockers. The last-mentioned especially call for consideration, if only because they are less under observation and control than the furniture which stands out in the open. The tops are now usually of glass or marmorite, and if it were only possible to get rid of the closed cupboards, it would not be difficult to design them so that every part could be readily and easily cleaned.

The mention of cupboards reminds me that these fittings are generally objectionable, and should be as far as possible banished from the ward. One at least is, of course, necessary for holding surgical and medical appliances, lint, medicines, &c., but it should not, as is frequently the case, be placed or built against the wall. It should stand out in the centre of the ward, and should be constructed of hard wood, framed and glazed all round and on top, and fitted with glass shelves. I am not certain that such a fitting commends itself to all Nurses. Some time since a Nurse complained to me that it cost her much labour and trouble to put away anything in these fittings, because, in effect, anything in the nature of disorder, or want of absolute cleanliness, could not be concealed even

from her own sense of order, not to speak of the Doctor on his rounds. I am sure that you will agree with me that therein lies the great virtue of this form of construction.

Fixed or heavy tables and chairs are to be avoided. It is possible to make a light table rigid.

Stoves.

A great number of the smaller paragraphs in the Building Press referring to hospitals, new and old, are inserted by makers of particular ward stoves which have been used in the building. There is no reason to doubt that they are excellent stoves for many purposes; but as they are built of iron plates and gills and plentifully adorned with mouldings, &c., they would appear to be entirely unsuitable to a hospital ward.

One or other of the forms of stoves which are built up with plain fire brick and bricks, or tiles, is far preferable. There is a greater amount of heat given out by radiation, and far less by conduction, and there are fewer lodgments for dust and dirt. Some of these brick and tile stoves are honeycombed with ventilating flues for heating air, which is conveyed by long horizontal flues from the outside. They would not appear to be open to objection, provided they are so constructed as to be kept clean easily.

Heating and Ventilation.

It is not the purpose of this paper to deal with such large and controversial subjects as heating and ventilation, or to enter into any discussion upon the relative merits of natural or mechanical ventilation.

It is only necessary to remind you that, whatever pipes or fittings are used, they should be so placed and constructed as to be readily cleaned. If possible, too, all controlling valves and pipes should be kept out of the ward.

Flues of any sort, whether in the floors or walls, should also be so constructed, with movable gratings and covers, as to allow of easy access for cleaning and disinfection.

Lavatory Basins.

Until quite recently, a fixed lavatory basin was, I think, regarded as quite inadmissible in the ward itself, but the inconvenience of hand basins, and the great improvement in the construction of fixed lavatories, have combined to overcome the objection to the latter. Of course, they are for the use only of the medical staff and the surgeons. The first hospital in which I saw them was one which has claims to being considered of the most modern design and construction: it is not yet quite finished. The

basins were, however, of an ordinary pattern, and fixed close against the wall, but I regret to add that underneath, the supply, waste, overflow and anti-syphon pipes (all on the surface of the wall) formed a perfect tangle of pipes.

Whilst mentioning these fittings, I should like to refer to the deceptive character of so many sinks and basins in the market, which are designed especially for hospital purposes. They are beautifully designed to avoid anything in the nature of dirt crevices or mouldings *on the surfaces* in sight, and so far only as they can be obvious to the casual observer. Underneath they are rough, angular, and full of pockets which are never likely to be cleaned from the day they are fixed. Much improvement is being effected by a few manufacturers to meet the persistent demands of those who value cleanness in the unseen parts as in those seen.

One other detail I have to refer to, and that is the necessity of what I may call "publicity" in every part of a ward and its adjuncts. It would seem desirable that in a general way both patients and nurses should always be under observation, or at least liable to be observed at nearly all times by the superior officers. If that appears to be objectionably stringent, I may add that it is not at all necessarily so.

I need scarcely say that I exclude the bath rooms and ward conveniences, but certainly the duty room and ward kitchen and separate day rooms should always be more or less open.

When patients know that they cannot escape even casual observation, they are more likely to behave themselves correctly, and the nurses themselves do their duty none the worse for the lack of opportunities of concealment.

It is better too that nurses should be continuously employed when on duty for shorter hours, than that the weariness of long hours should lead them to lounge or neglect their duties when occasion offers.

(For discussion on this paper, see page 384).

ELECTRICITY FOR SMALL HOSPITALS.

By W. NOBLE TWELVETREES, A.M.I.E.E., M.I.Mech.E.

(Member.)

ALTHOUGH electric light is now fairly universal in large hospitals, it is too seldom adopted in small institutions situated in more or less remote districts where public supplies of electricity are not available, and in many small institutions where the engineering equipment is of very limited character. Moreover, the convenience and economy of electricity for the provision of power and heat in hospitals are still inadequately recognised.

The object of this paper is to deal with some essential points connected with the supply and generation of energy, and the author hopes to show that the hygienic and other advantages following the application of electricity may be secured, even in the smallest hospitals, by extremely moderate outlay and subsequent expenditure.

In districts where current is obtainable from the systems of municipal or industrial corporations, it may often be thought advisable to buy the current required. Such a decision may be influenced by the laudable desire to support an industry conducted by the local authority; by the low rates charged in a particular district; or, in the case of a very small hospital, by the consideration that outlay for the establishment of a separate source of supply would be unjustifiable. The sale price of energy varies very much in different places, and not always proportionately with the price of coal, which is the factor chiefly governing the cost of actual production. In many districts those employing current for power receive specially favourable terms, and this introduces another element for consideration. Charges for lighting are almost invariably based upon what is termed the "maximum demand system," according to which the rate for the first hour is generally double the rate for succeeding hours. This method has the effect of levying from all consumers a fair proportion of expenses incurred over and above the actual cost of energy at the works, and it also has the advantage of encouraging the consumption of current

for a larger number of hours. To illustrate the variable nature of charges, some figures are quoted in Table I. from accounts recently published for the year 1902. Although these data were not specially selected, they show fairly well the rates prevailing in towns where local conditions are essentially different.

Table I.—*Charges for Light and Power in 1902. In pence per Board of Trade unit.*

Place.	Light.	Power.	Average (Net).
Huddersfield	4·5d.	2·5d. & 1d.	3·75d.
Hull	5d. & 2d.	2·0d. & 1d.	3·80d.
Northampton	6d. & 3d.	2·0d.	4·70d.
Worcester	4·7d. (average)	3·48d. (average)	3·77d.

While the general average is only 4·00d. per unit, considerably more is payable for energy used for lighting, and inspection of the figures shows clearly that the purchase of current is less advantageous for hospitals where electricity is employed for lighting alone, than for those where it is utilised in the provision of both light and power. On comparing Tables I. and II., a very important difference is seen to exist between the sale price and the cost of energy, and, moreover, the sale price does not appear to be governed by the works cost. The difference between cost and sale prices is accounted for by the expense of distribution, general trading expenses, and profit. In the case of a public hospital, the equipment of a generating station involves no liability in respect of rent, rates and taxes, and its operation adds practically nothing to the cost of management. All modern hospitals possess steam boilers and auxiliary plant, and thus the motive power for generation can be furnished at far less cost than in an establishment where boilers have to be specially worked for electrical machinery. The cost of attendance will be very little increased, or may not be increased at all. It is a generally accepted rule that a given product cannot be manufactured so economically in small establishments as in large works, but there is reason for anticipating that the cost rate per unit of electricity generated in a public institution should be less than the average sale price charged by electricity supply corporations. It may here be added that according to a recently published summary of electric supply records for 1901, the average works cost in Great Britain was 1·74d., and the average price obtained for light and power was 4·47d. The highest and lowest prices were 7·06d. in Harrow, and 2·41d. in Prescot.

TABLE II.— *Works and Distribution Cost of Electric Energy in* 1902. *In Pence per Board of Trade Unit.*

ITEMS.	HUDDERSFIELD.	HULL.	NORTHAMPTON.	WORCESTER.
Fuel	·37d.	·84d.	·46d.	·63d.
Water and Engine Room Stores	·05d.	·07d.	·04d.	·07d.
Wages for Generation, Distribution, &c.	·44d.	·53d.	·69d.	·44d.
Maintenance	·31d.	·31d.	·33d.	·31d.
TOTALS	1·17d.	1·75d.	1·52d.	1·45d.

We will next inquire into the probable cost of producing energy in a hospital generating station. In the first place it may be convenient to define the machinery and appliances required, and to indicate the relation between capital expenditure and output.

The absolute essentials of a generating plant are the following:—

1. Prime mover, furnishing motive power by the agency of steam, gas, or oil;
2. Dynamo, generating current at the required voltage;
3. Main switchboard, for the regulation and distribution of current.

To these it is usually desirable to add

4. Storage battery, the cells varying in number with the required voltage, and in capacity with the discharge in ampere-hours.

Steam and other engines are now provided with such efficient means of control, and dynamos are made to run so steadily that the storage battery is not so much a necessity as a convenience. In hospitals where electric energy is simply used for lighting, the generating set is, or ought to be, quite separate from the engine employed for driving laundry and other machinery, and the installation of a battery permits the storage of electricity during the day, when steam can conveniently be spared. Thus the generating plant need only be operated for a few hours daily, and current required in the evening can be drawn entirely from the battery. In cases where energy is applied both for light and for power, the battery can be slowly charged throughout the day, and used (either alone or in conjunction with the generator) for carrying the evening load. As the voltage required for charging a battery is about one-third more than the normal voltage, it is evident that some means of adjustment must be provided if charging is to be conducted while the generator is being used for other purposes. The most satisfactory method is to add a machine of the type known as a "booster," which is capable of raising the voltage of current from the ordinary circuit to the voltage necessary for charging. As

usually made, the booster consists of a small dynamo and a motor of suitable power (Fig. 1), combined to form a self-contained and very compact

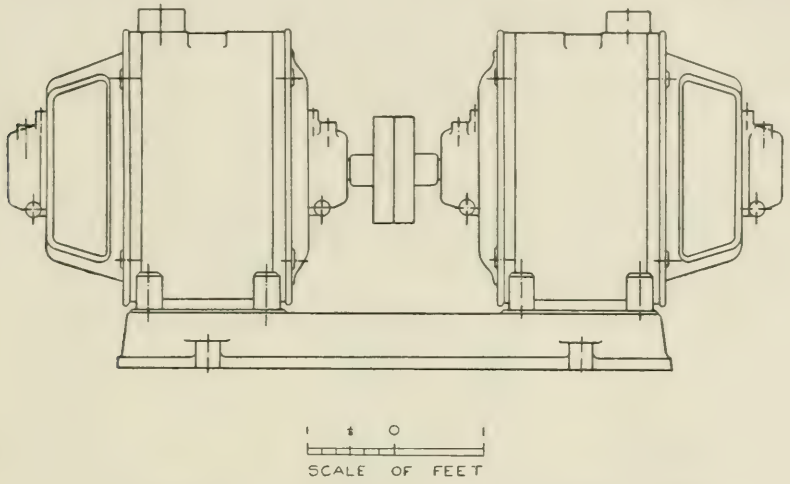


Fig. 1.—Booster, or Motor-Dynamo (Crocker-Wheeler System).

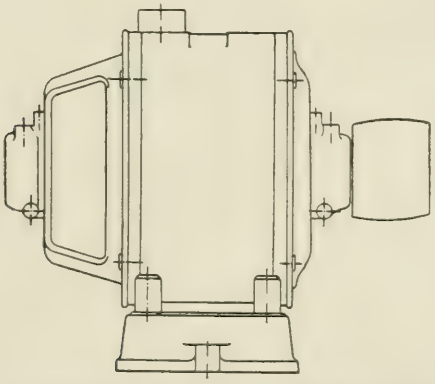


Fig. 2.—Belt-driven Booster (Crocker-Wheeler System).

machine. The booster is also made without the motor, and in this form it can be driven from the shaft of the main generator, or in any convenient manner (Fig. 2). In special cases where highly fluctuating loads occur, owing to the sudden starting of machines absorbing considerable amounts of power for a few moments, a booster can be applied in connexion with a small regulating battery, and so connected that the average current of the variable load may be supplied as a constant load, the battery being charged while there is little or no demand for power, and discharged heavily when

the momentary strain comes on; thus adding to the normal supply from the booster sufficient current to meet the augmented demand. Such an arrangement prevents injurious shocks in the generating set, and various unsatisfactory disturbances of the service generally.

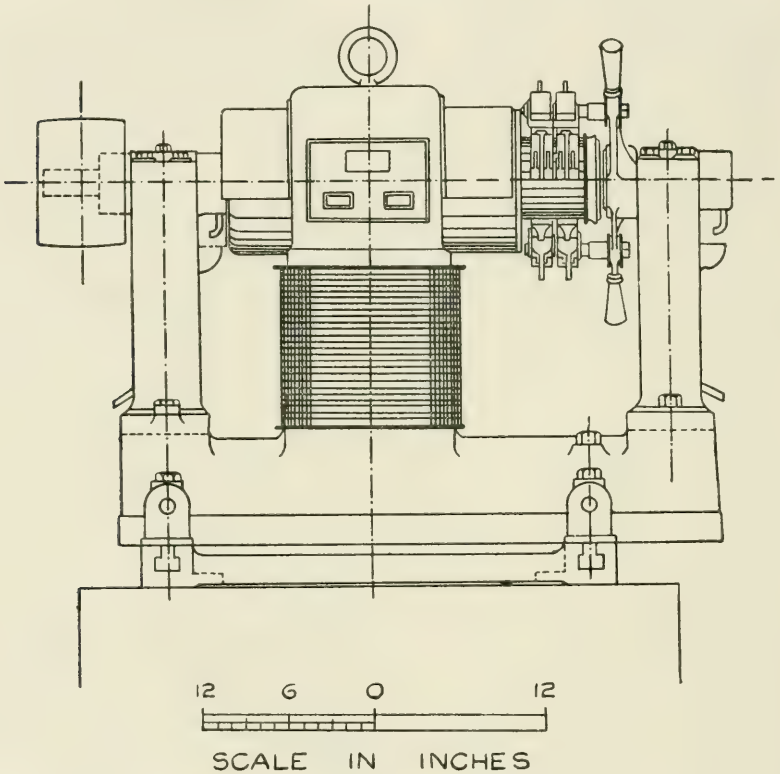


Fig. 3.—10-kilowatt Dynamo (E.C.C. Type).

For the purpose of affording a basis for calculation, a small power station recently equipped under the direction of the author will be taken as an example. This installation was designed simply for lighting, but it would be quite capable of dealing with a moderate power-load in addition. The capacity of the plant is 10 kilowatts, or 100 amperes at 100 volts; which is sufficient for the continuous supply of 155 sixteen-c.p. lamps. The storage battery has a capacity of 216 ampere-hours when discharging in 6 hours, and the rate of discharge is then 36 amperes per hour. This capacity is sufficient for the present requirements of the institution, and is equivalent to an annual output of about 8,000 Board of Trade units. Motive power is provided by a quick-revolution vertical engine, operating

a belt-driven bipolar continuous-current dynamo, the main features and dimensions of which are shown in Fig. 3, and steam is furnished from the boiler provided for the general supply of heat and power for ordinary purposes. The cost of the machinery and plant, erected in working order, was £475; but to this should be added the amount of £100 to cover the increased cost of boilers, owing to the higher pressure necessary for the electric light plant. The total capital expenditure is thus brought up to £575.

In considering the further outlay required to make the plant available for power as well as for light, it is only necessary to add the cost of providing and fixing a booster, say £100; as the value of the laundry engine and auxiliaries is about the same as that of the electric motor and fittings that would be required instead. Thus, £675 represents the total capital value of the plant for light and power. If fully employed for light and power during five days a week, and for light alone during the remaining two days, the annual output would become 23,000 units.

Calculated upon the amounts stated above, the annual repayment of principal with interest at 3 per cent., extending over 20 years, would be, say, £40 for light alone, or £47 for light and power. The amount to be included in the total cost of energy on account of repayment and interest is consequently 1·2d. per unit in one case, and 0·5d. per unit in the other.

In a steam plant, coal is the chief item for consideration. Taking the consumption at 7 lbs. per brake horse-power, or, say, 10 lbs. per kilowatt, the cost with fuel at 15s. per ton comes out at 0·8d. per unit. Water and engine-room stores may be put down at 0·07d. per unit; an increase of 1s. a day in the engine-driver's wages would represent 0·55d. per unit on the output of 8,000 units, or 0·2d. per unit for the output of 23,000 units. Including 5 per cent. on the value of the plant for maintenance and repairs, and including also the items in respect of repayment and interest, we have the figures stated in Table III.

Table III.—*Estimated Cost of Electrical Energy in Hospital Installation. In Pence per Board of Trade Unit.*

Items.	Light Only.	Light and Power.
Fuel	·80d.	·80d.
Water and Engine Room Stores	·07d.	·07d.
Attendance (extra)	·55d.	·20d.
Maintenance	·75d.	·37d.
Works Cost	2·17d.	1·44d.
Repayment and Interest	1·20d.	·50d.
Total Cost	3·37d.	1·94d.

Results such as these are only to be attained if the entire plant is properly designed and managed. The efficiency of all details must be considered, and capacity must be duly proportioned to the required duty.

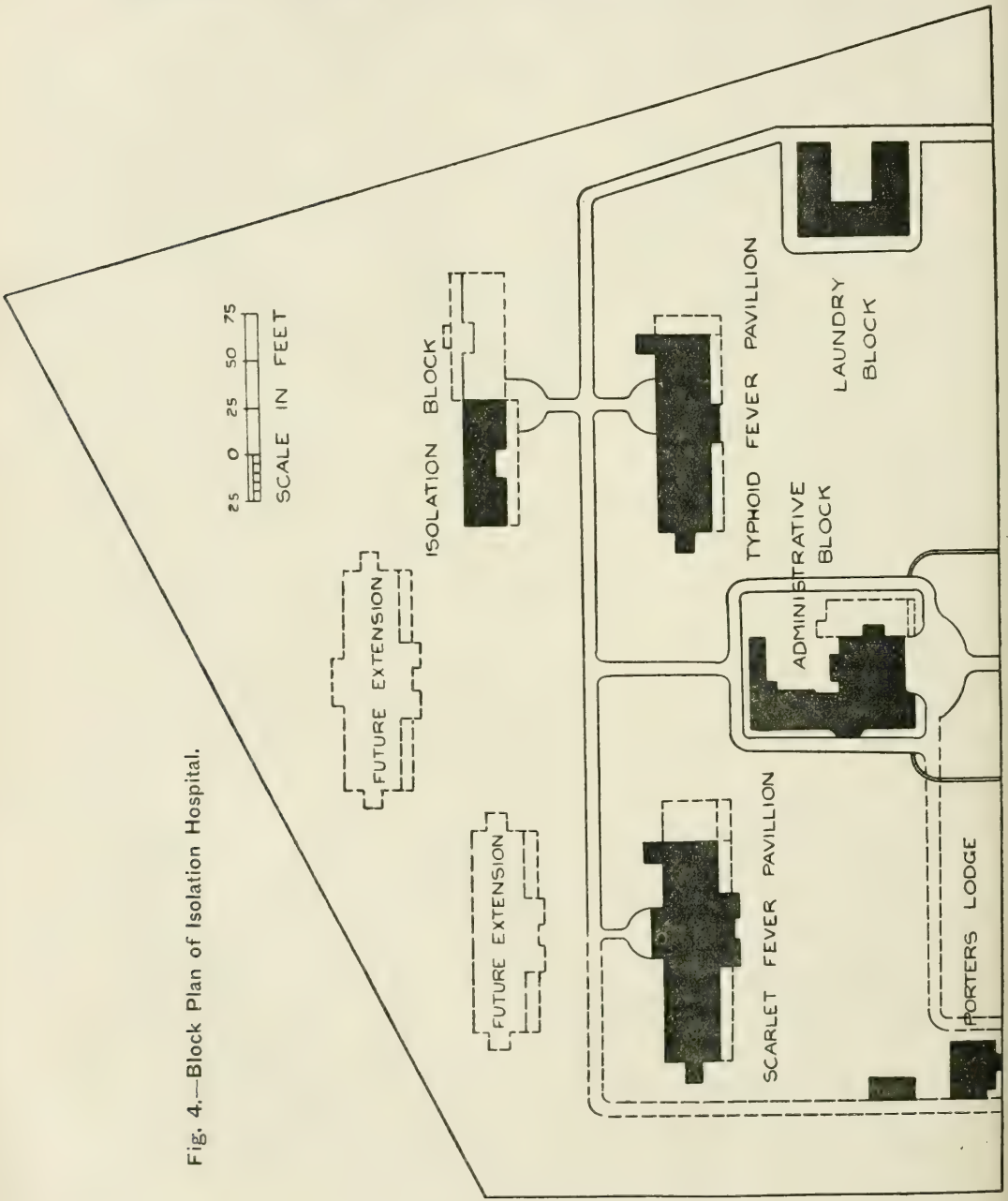
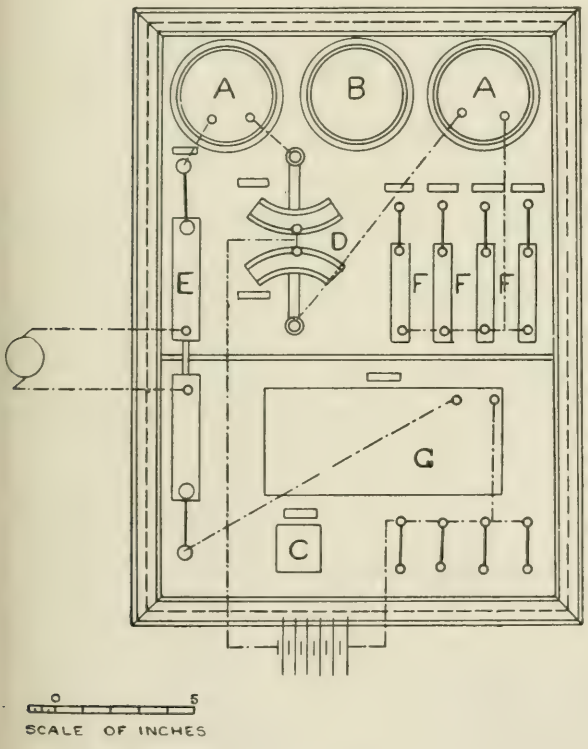


Fig. 4.—Block Plan of Isolation Hospital.

The boiler plant must be designed so that perfect combustion of the fuel may be secured, stoking should be effected by mechanical means, and the excess heat contained in the furnace gases should be utilised by the employment of fuel economisers. Every available means should be adopted for utilising exhaust steam and water of condensation, and loss of heat from the surfaces of the boilers and steam-pipes should be minimised by suitable non-conducting material. Unless precautions such as these be taken, the cost of electricity will be materially increased, although it is most likely that no accounts will be forthcoming to demonstrate the fact.

With the object of showing that electric light is already being applied in small hospitals, a block plan is given in Fig. 4 of an isolation hospital now being equipped with electrical plant. The power station is situated in the laundry block, and the switchboard diagram (Fig. 5) will make



A A Ammeters for measuring current.
B Voltmeter for measuring Voltage or Pressure.
C Voltmeter Switch.
D Charge and Discharge Battery Switch.
E Main Switch.
F F F Switches for four circuits to different buildings.
G Automatic Cut-out for Battery.

Fig. 5.—Diagram of Main Switchboard.

clear the means available for regulation of the current, and for control of the circuits supplying the different buildings.

So far as structural work is concerned, very little outlay is involved in the application of electrical plant in a hospital. In new buildings the dimensions of the ordinary boiler house need not be increased, unless space has been unduly economised; an engine room of average size will be ample for the generating set and main switchboard, but space must be found for the accommodation of the storage battery. Some idea of the dimensions actually necessary may be obtained from Fig. 6, which shows

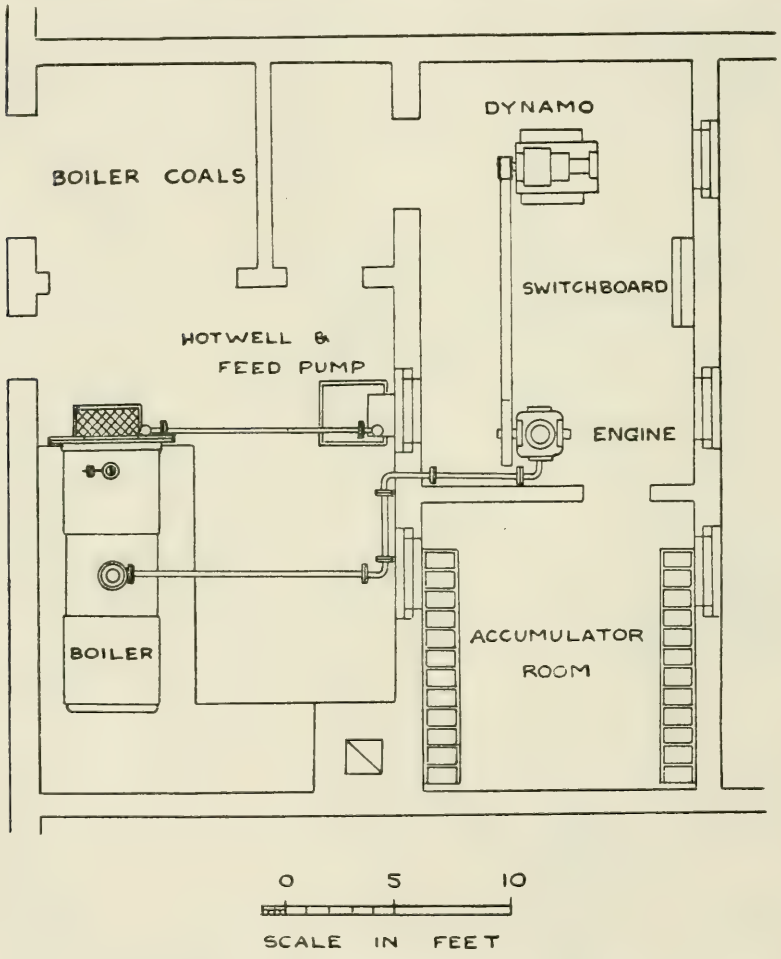


Fig. 6.—Plan of Electric Light Station for Small Hospital.

the arrangement of a 10-kilowatt plant, with boiler house, dynamo room, and battery. It will be observed that space is here left for the addition of a second boiler. The battery room must be well ventilated in such a

manner that acid vapour may be discharged at a sufficient distance above the roof. The floor should be asphalted or tiled, and made with a suitable fall to prevent the accumulation of water, and the interior walls, roof, and timber fittings should be protected with acid-proof paint. In existing buildings, where boilers are already provided, it will generally be necessary to extend the boiler house to afford space for the addition of another boiler. If this should be impracticable, or, owing to exceptional circumstances, undesirably expensive, it may be advantageous to leave the boiler house as it stands, and to make use of a gas or oil engine for the provision of motive power.

The internal combustion motor has several advantages which commend it for use in connection with electric generators. In places where steam is not required for other purposes, this type of engine provides power more cheaply than the steam engine, and one great advantage it possesses is that of adaptability to intermittent work. When the engine is stopped the consumption of fuel instantly ceases, whereas in the case of the steam engine, there is continuous waste of fuel during the intervals of work. Hence the internal combustion motor is particularly suitable for very small institutions, where the general demand for steam is of limited extent.

Only a year or two back the running of the gas engine was far from satisfactory, but at the present time several well-known firms are making special types of electric light engines that give a perfectly steady current without the application of a fly-wheel to the dynamo, as was formerly necessary. Another improvement is to be found in the diminished consumption of gas, and various engines are now to be obtained in which the volume required per brake horse power is between the limits of 15 cubic feet and 25 cubic feet per hour. As our attention is devoted particularly to electricity for small hospitals, we will take the consumption of gas at the upper limit of 25 cubic feet per b.h.p., or say, 37·5 feet per kilowatt. With gas at 2s. 6d. per 1,000 cubic feet, the cost of energy works out at about 1·12d. per unit. Substituting this value for the cost of coal given in Table III., we find that the total cost of generating energy in a gas-driven plant to be 3·69d. per unit for light alone, or 2·26d. per unit for light and power. At the average rate of 30 cubic feet per kilowatt, the cost of production would be 3·47d. in one case and 2·04d. in the other. No alteration is necessary in the item referring to repayment and interest, because the higher cost of the gas engine practically balances the saving in respect of the amount allowed for increased boiler power.

Before leaving gas engines it may be well to direct attention to the efficiency of gas employed in direct lighting, and in electric lighting

through the medium of a gas engine. The amount of light furnished per cubic foot per hour by the three best-known forms of gas burner is stated in Table IV., the burner in each case being new and in perfect condition.

TABLE IV.—*Light given in Direct Lighting by One Cubic Foot of Gas.*

TYPE OF BURNER.	CANDLE POWER.
Batswing	2·75 to 3·00
Argand	3·00 to 3·50
Incandescent	12·00 to 15·00

When consumed in a gas engine at the rate of 37·5 cubic feet per kilowatt, each cubic foot of gas will give 6·65 candle-power in the form of electric light, approximately 2·3 times the light furnished by an ordinary burner, twice that by an argand burner, and half that by an incandescent burner. Although the superiority of the incandescent burner is very marked at first, its economy is not maintained. In about 100 hours the efficiency has fallen off more than 25 per cent., and in 300 hours more than 33 per cent. Similar loss of efficiency is found in the incandescent electric lamp, but not in the same degree, for the original candle-power is not diminished by 33 per cent. until the lamp has been used for some 600 hours.

A matter of much importance, from the hygienic standpoint is the effect of illuminants upon the atmosphere of the space in which they are burned. The following table, taken from Dr. Louis Bell's recent work,

TABLE V.—*Vitiation of Air by the Combustion of Oil and Gas (Bell).*

Illuminant.	Quantity per hour.	Candle Power.	Oxygen consumed. Cubic feet.	CO_2 produced. Cubic feet.	H_2O Vapor. Cubic feet.	Vitiation = adult persons.
Paraffin Oil.....	992 gr.	16	6·2	4·5	3·5	7·5
Kerosene Oil	909 gr.	16	5·9	4·1	3·3	7·0
Gas (Batswing)	5.5 c.f.	16	6·5	2·8	7·3	5·0
„ (Argand)	4.8 c.f	16	5·8	2·6	6·4	4·3
„ (Welsbach)	3.5 c.f.	50	4·1	1·8	4·7	3·0

"The Art of Illumination," gives the approximate effects produced by the combustion of oil and gas, so far as concerns vitiation of the air. The fact that each ordinary gas burner will vitiate the air of a room to the same extent as five adult persons is a strong argument in favour of electric light, and the enormous hygienic advantage to be gained should alone be sufficient to justify its adoption in place of gas, even at a slightly increased

cost. Another argument in favour of electric light is to be found in the deterioration of painted, distempered, and other surfaces in buildings where gas is employed for direct lighting, and it is possible that the cost of re-decoration may frequently equal, if it does not exceed, the difference between the two methods of illumination.

The oil engine offers another alternative to steam for the generation of electrical energy. In many parts of the country it will be found more convenient and more economical than the gas engine. For small country hospitals, where no public supply gas is available, the oil engine often presents the most economical means of providing motive power for the generation of electricity. In design the oil engine is practically the same as the gas engine, with the addition of a vapouriser at the end of the cylinder. Any common form of petroleum oil may be used, such as Royal Daylight, Tea Rose, Broxburn, or Russolin. These and other oils of the kind are readily obtainable in any part of the country, and they have the recommendation of being both cheap and safe. The consumption in well-designed engines, as small as seven brake horse power, is not more than 0·82 lb., or one-tenth of a gallon, per brake horse power. Allowing 1·2 lbs., or 0·15 gallon per kilowatt, the cost of oil at 4d. per gallon does not exceed 0·6 per unit of energy produced. Substituting this value for the cost of coal as stated in Table III., we find the total cost of energy from an oil-driven plant to be 3·17d. for light alone, or 1·74d. for light and power. As before, no alteration has been made in respect of repayment and interest, as the value of the plant remains practically unaltered.

Comparing the efficiency of oil used for direct lighting, and for lighting by electricity through the medium of an oil engine, we find a considerable advantage follows the latter method of procedure. Table VI. contains a summary of some results obtained by Prof. Vivian B. Lewes from a selection of twelve different lamps in use at the present day:—

Table VI.—*Consumption of Oil in Direct Lighting, in Grains per Candle-power per hour (Lewes).*

Type of Wick.	American Oil.	Russian Oil.
Circular	60·32	75·11
Flat, Single	62·63	74·00
„ Duplex	53·70	51·15
Average	58·88	66·75

Taking the general average of 63 grains per candle-power as the basis of calculation, we find that the consumption of 63 grains of oil in an engine, at the rate of 1·2 lbs. per kilowatt, would produce 1·87 candle-power in the form of electric light, nearly double the amount obtained by direct lighting.

Reference to Table V. will show the effect produced upon the atmosphere of a room by the direct combustion of paraffin and kerosene, and it will be seen that the volume of CO_2 is from 150 per cent. to 250 per cent. greater than that due to gas, and that one oil burner in the room has the vitiating power of from 7·0 to 7·5 adult persons.

Another form of fuel which is rapidly coming into general use for internal combustion engines is known as producer or power-gas, a product which is destined to effect great changes in existing methods of developing power. In some parts of the country arrangements are already being made for the distribution of this gas on a large scale, and as it can be produced from the cheapest forms of fuel, the sale price will probably not exceed 2d. per 1000 cubic feet. Allowing for the lower calorific value of this product, which is about one-fourth that of coal gas, the equivalent cost would be about 8d. per 1000 cubic feet. In a plant of the size previously defined, the use of power-gas would reduce the cost of fuel to about 0·2d. per unit, and the cost of electricity to about 2·77d. per unit for light alone, or to 1·34d. per unit for light and power.

Some of the general results already ascertained are summarised in Table VII., and the cost of gas and oil are stated in Table VIII., in a form convenient for comparison.

It will, of course, be understood that these figures are merely intended to represent the cost of energy at the switchboard, or of illuminating material at the point of distribution. The figures relative to the genera-

TABLE VII.—*Estimated cost of Electrical Energy in Hospital Installation, in Pence per Board of Trade Unit.*

Motive Power.	Cost of Production.			
	Plant partly used.		Plant fully used.	
	Works cost.	Total cost.	Works cost.	Total cost.
Steam Engine; coal at 15s. per ton	2·17	3·37	1·44	1·94
Gas Engine; gas at 2s. 6d. per 1,000 c. ft.—				
Average consumption	2·27	3·47	1·54	2·04
Maximum „	2·49	3·69	1·76	2·26
Oil Engine; oil at 4d. per gallon	1·97	3·17	1·24	1·74

Table VIII.—*Cost of Gas and Oil for Direct Lighting, in Pence for a quantity producing the same c.-p. as One Board of Trade Unit of Electricity.*

Illuminant.	Average of Various Burners.	Batswing Burner.	Argand Burner.	Incandescent Burner.	
				New.	At 300 hours.
Gas at 2s. 6d. per 1,000 cub. ft.	1·54	2·61	2·30	·56	·75
„ „ 3s. 0d. „ „	1·82	3·1	2·76	·67	·80
„ „ 3s. 6d. „ „	2·14	3·6	3·23	·78	1·05
Oil at 4d. per gallon	1·12	—	—	—	—

tion of energy apply particularly to the installation which has been taken by the author as fairly representative of a small hospital plant, and although variations of output and working conditions have been considered, the results are not of universal applicability. Hence, it is impossible to institute an exact comparison between the calculated cost of electricity per unit, and the equivalent cost of gas and oil. Nevertheless, we may fairly assume that similar ratios will generally exist between the cost of the various methods of producing power and light.

The following conclusions may be drawn from the foregoing investigation:—

1. That electrical energy can be generated in a hospital of moderate size, even under unfavourable conditions, at a cost considerably lower than the average rate charged by public supply corporations.

2. That economical production is greatly aided by utilisation of the generating plant for power as well as for light.

3. That under favourable conditions energy can be generated at such cost that electric lighting becomes less costly than direct gas lighting when ordinary burners are employed, although more costly than gas lighting by incandescent burners, and more costly than direct lighting by oil lamps.

4. That in view of its deleterious effect upon the atmosphere, the combustion of gas and oil for the direct lighting of hospitals is distinctly inadvisable; and that these substances may be more advantageously employed in the provision of motive power.

5. That the facilities offered by modern gas and oil engines are such as to place electricity within the reach of all hospitals, for which the outlay upon generating plant has hitherto been regarded as unjustifiably heavy.

Much might have been added as to the economy and convenience of electricity as a source of power for general use, and of heat for special

purposes; and also as to the hygienic advantages to be gained by its application in the form of light.

The author has thought it better, however, to confine his attention chiefly to the means available for the generation of electricity under various conditions, with the object of showing that no obstacles exist in the present day which need prevent the adoption of this agency in all hospitals and kindred institutions.

In conclusion, he desires to express the hope that discussion of the subject may materially strengthen the opinion that electricity should now be regarded as a cheaply-purchased necessary, rather than an expensive luxury.

[*This discussion applies also to the paper by* Mr. Alfred Saxon Snell.]

Mr. T. W. Aldwinckle (London) said that the terrazzo floor was very easily cleaned, but it was distinctly cold, and one great objection was that it was very liable to crack. There was one good example in this country, viz., at the County Infirmary at Derby, where the authorities were very well satisfied with it. It was in general use in Germany, and there was one special case of a hospital he had visited, the Eppendorf Hospital near Hamburg, where the floors were laid with terrazzo, and to get over the difficulty of its coldness it was warmed by a series of hot air chambers under the floors. That must be a very expensive way. Mr. Snell had referred to maple: it made a very good flooring and it was cheaper than teak, but owing to the increasing consumption the price was rising; his objection to it was on account of its tendency to shrink. He was prepared to agree with Mr. Snell that teak was a long way the best hospital floor it was possible to have. He had used some acres of it in various parts, and he spoke with the experience of some years when he said he had never had an unfavourable opinion of it from any hospital authorities who had used it. To his mind the colour which was dark was a good feature; it gave a cosy appearance which was wanting in the case of maple or the lighter woods. There was not the slightest fear of any accumulation of dirt on a well waxed floor. The skirting ought to be of the same material as the floor. The only difficulty was to make a good joint between the plastering and the skirting. They would never do better for the walls than plastering with Keene's or other good cement; it could be laid on without producing any cracks. It lent itself after a year or two to being covered with a thoroughly non-porous paint, which was the best finish and one admitting of being easily cleansed. He gathered from Mr. Snell that he was in favour of the Middlesex type of window, which consisted of a solid frame and four or five sashes. As a matter of personal preference he was inclined to the

old-fashioned double hung sashes with hopper above, and the lower sash in one square of plate glass. It was a much more cheerful window than the Middlesex casement window, which it was sometimes difficult and perhaps even dangerous to open. With regard to cupboards, these should be made so that it was quite easy to see clearly through them; and as regarded stoves he sympathised with Mr. Snell's preference for the open fireplace. Open fireplaces were very necessary in a hospital ward. They were not only materially conducive to that cheerfulness of the patient which was almost part of the proper system of treatment, but they were also among the best of ventilators, and they ought never to be abolished in deference to any other system of ventilation. He was inclined to think it best that the stoves used should be simply warming stoves, and should be entirely disassociated from ventilation flues for heating air, for the amount of air which could come through them was very limited, and it was practically impossible to keep the air channels clean.

DR. HERBERT JONES (Hereford) said the paper of Mr. Saxon Snell was a very practical one. The general principles of hospital construction were already settled. What architects wished to learn was as to matters of detail. Mr. Snell was very well advised when he said that they must make the cleaning of the ward as easy as possible. The next desideratum was that they should make the administration of the hospital as little costly as possible. If they could by attention to details save one ward maid, that meant a saving of £50 a year, which might be calculated as equivalent to a capital sum of £1,000 on the original outlay. There was so much excellent detail in Mr. Snell's paper that it was difficult to find anything that he had missed. There were, however, one or two points which must be added. The comparative size of wards was worth attention. If the hospital had two large wards, one on either side of a corridor or a duty room, it was desirable that these should not be of the same size. He was not speaking of hospitals where there were eight or ten pavilions, but of small ones with thirty or forty beds. The question of the flooring of wards had not been finally settled. Mention had been made of terrazzo. Many people did not approve of it because it was cold. It had been put into one or two hospitals in which he had been himself concerned, and his experience was that it was not cold. From enquiries he had made of nurses who were actually using it, he learned not that it was cold, but that it was not sympathetic to the tread: it was most tiring to walk upon. Nurses who had to walk upon it said they were tired out in half the time that they would be if walking on a wood floor. What they wanted was a floor which was impervious, but at the same time was elastic and sympathetic. That it cracked was, he supposed, no fatal objection; if it did crack it could be filled up. Mr. Snell had mentioned that the angles of the walls should be curved. In the Burton-on-Trent hospital the angle of the walls with the ceiling was moulded in a curve of nine or ten inches radius instead of $2\frac{1}{2}$ or 3 inches as is usual. The effect was most pleasing. It gave a dome-like

effect to the ceiling which added very much to its appearance. The walls should certainly not be covered with tiles. In one hospital he had been concerned with the walls were covered with enamel paint. This was an absolute failure, for the enamel peeled off. The paint which he had found most successful was Blundell and Spence's vitreous paint. The question as to the material with which ceilings should be covered was a difficult one. If a ceiling was made non-porous it would not have the necessary elasticity, and the consequence was, as he had seen again and again, that the cement immediately began to crack. Although the double hung sash was a very useful window, it had this disadvantage, that the space in which the weights run was very often a perfect dust bin. The objection to the ordinary casement window was that it rattled. But he did not think this was inevitable. The Middlesex hospital window answered its purpose exceedingly well, but he doubted whether it would be any better than an ordinary casement window. The question of doors Mr. Snell had not touched. Architects had done away with shelves and crevices for dust everywhere else. Yet they deliberately provided them in the panels of the doors. He had seen in Bradford a door called the Downson-Taylor door which was practically solid. It was not made for ordinary purposes but for fireproof purposes, and was a hollow-solid door without panels. One had been erected to divide the King's Arcade in Bradford. He thought it was perhaps on the lines suggested by the door that Mr. Snell might be able to solve the problem of doors. The paper on electric light in small hospitals was very important, because the electric light was undoubtedly the best form of artificial light for such institutions. He said that in many small institutions and in private houses he had found that there was no special man to look after the installation, which was often superintended by a groom or gardener. This was a practical point deserving the attention of those who were about to advise the installation of small electric lighting plant.

Dr. Fremantle (Hertfordshire C.C.) said that framed pictures in hospitals provided gathering places for dust, and thus many hospitals had been led to remove pictures from their wards altogether. The question of how to make the wards look bright had been considered in the renovation of Guy's Hospital. They had been reminded of the work once done by Millais, Morris, Burne-Jones, and the other young Pre-Raphaelites at Oxford; and it had been suggested to them by Mr. G. F. Watts and Mr. Holman Hunt that they should try to get some of the young painters of the present generation to join together for the purpose of painting the walls of their hospitals. But they had gone into the matter of materials, and there was no one material which was quite suitable. At one hospital a wall-painting in oil was scrubbed, during the Sister's absence, with most unpleasing results. Glass Mosaic with a broad design was the best method at present, but it was very expensive. At Guy's Hospital they had gone into the matter, and it was estimated that £2,000 would be required to carry out

the design for a single ward. He asked architects, by collaboration with artists, to devise some method of coating walls so as to be suitable for painting.

Mr. Alfred Saxon Snell (London), replying on the discussion, said that Mr. Jones had referred to the desirability of having wards of different sizes. He quite agreed. That was a system which he had adopted at Charing Cross Hospital. One never could be certain that they would not have more men than women, or *vice versâ*, in the hospital. He congratulated Mr. Jones on having been able to get the testimony of a nurse in regard to the flooring. That was more than he had been able to do. As a rule they seemed frightened to give their own opinion in reply to a question, and the answer he was sure to get was that which would be considered officially correct. He thanked Mr. Jones for that term "sympathetic." That was exactly the word they wanted to describe a floor in which there was no spring. In respect to windows, a model of a window was being shown by Messrs. Leggott, of Bradford, which could be opened to the fullest extent, so that one got the fullest amount of air. It was the one he had designed for Charing Cross Hospital. He agreed that they wanted solid and not panelled joinery. He had recognised this, and as he had already stated he was having Canadian doors made without panels. Certainly wall paintings were better than hanging pictures. It was pleasant to hear of a number of painters combining to decorate a building as a labour of love. He wished some one would introduce him to such a band of Pre-Raphaelites. Pictures could be covered and preserved with good varnish, but by the time a picture had got two or three coats of varnish upon it it would be indistinct. He suggested that the picture might be painted on canvas and covered with plate glass.

PUBLIC BATHS.

THE INFLUENCE OF PLANNING AND CONSTRUCTION UPON THE COST OF MAINTENANCE AND ADMINISTRATION.

By ALFRED SAXON SNELL, F.R.I.B.A.

(Fellow.)

THE value of public baths in the cause of public health is, I presume, undisputed. It was recognised as long ago as 1846 when the Act of that date was passed enabling public authorities to build and maintain these institutions, and it was also obviously recognised therein that they might not be self-supporting.

It is a curious feature of the Act that it limited the number of first-class baths (that is to say those which might possibly be remunerative) to not more than half that of the second-class or cheap baths. I think that even this allowance was made as a concession for the benefit of the class which may be called the moderately poor, which is willing to pay a little more for better accommodation. Bath managers know, however, that these better class baths are the only ones that are really remunerative, and they help thus to pay for the cheaper class; and the business instinct in public bodies which is responsible for that bugbear to our conservative instincts, Municipal Trading, has suggested that it might be possible to make baths really *pay* if the limitation on the number of first-class baths was removed.

I shall not enter upon the thorny paths of a defence or otherwise of municipal trading, but one may safely premise that however much we may differ as to the particular undertakings which may with advantage be conducted by public authorities, it is in the highest degree desirable that all such undertakings should, as far as possible, be placed on a business footing and conducted so as to impose as small a burden as possible upon

the rates and taxes of the community. Only so can we guard against reaction from the municipal spirit which has done and is doing so much to improve our public services. Only so can we get liberty to spend even more freely in improvement and progress. Much thought and energy is spent year after year in this direction, but the effects scarcely keep pace with the ever increasing demand for greater efficiency and its consequent greater expenditure.

This is particularly the case with respect to public baths, and it is my purpose to point out some directions in which economy might be exercised without detriment to the buildings, and without impairing their efficiency.

The cost of an unremunerative undertaking is practically to be reckoned by the annual income it absorbs, and in the case of a building, this may be made up as follows:—

(*a*) Interest on first cost of building and sinking fund.

(*b*) Maintenance and repairs of building.

(*c*) Working expenses.

The maintenance and repairs will depend upon soundness of construction and permanence of the surfaces.

The working expenses are dependent generally upon good arrangement, but also largely upon the planning of the building.

How, and in what direction, is it possible to economise wisely in respect of the first cost of a building?

SITES.

The first consideration is the nature of the site for the building: and although I know I am at variance with some authorities upon bath planning, I venture to say that the idea that any sort of site is good enough for baths is radically wrong, although on superficial grounds it is hard to controvert. It appeals to that instinct for short sighted economy which does so much to hamper real progress, and thwart the best efforts. It has, I am sure, been responsible in London especially for the selection of some of the most extraordinary sites which have taxed the ingenuity of architects to use to advantage. Such sites almost invariably entail straggling, and therefore uneconomical plans. The various sections are necessarily so placed, that many of them cannot be reached from the entrance except by means of long corridors, which are wasteful, and quite useless for any other purpose.

WASTE CORRIDORS.

To illustrate this point, I show below in a tabulated form, the proportion of area of "means of communication," including halls, staircases and

corridors to the accommodation of a number of Public Baths. It would be invidious to give the names of these buildings for obvious reasons, but I may say that all of them are well-known and modern establishments, some in London, and the remainder in certain provincial towns and cities.

Each establishment comprises two or more of the following separate sections, viz. :—

Swimming Baths (1 or more).
Warm Baths (2 or more sets).
Turkish Baths (1 or more sets).
Public Wash House.
Boiler House and Towel Laundry.
Administrative Offices and Superintendent's Quarters.

In nearly every case the nature of the site has been mainly responsible for the excess of waste room.

TABLE.

Example.	Swims.	Warm Bath (Sets).	Turkish Bath (Sets).	Administrative Offices.	Boiler House, &c.	Wash-house.	Total Number of Sections.	Area of Corridors.	Area per Section.
1	3	4	.....	1	1	1	10	6600	660
2	4	4	.....	1	1	1	11	6280	571
3	2	4	.....	1	1	1	9	5130	570
4	4	4	.....	1	1	1	11	6000	555
5	3	4	.....	1	1	1	10	5000	500
6	3	4	1	1	1	.....	10	4230	423
7	3	4	.....	1	1	1	10	3050	305
8	4	4	.....	1	1	1	11	3000	272
9	3	4	.....	1	1	.....	9	2350	260
10	2	4	.....	1	1	.....	8	1145	143
11	2	4	1	1	1	.....	9	1013	112

I commend these figures to your careful consideration, and further to such of you as are interested in the planning of these Institutions, I suggest that you make a similar comparison of any establishments which you may know, and I feel sure you will agree that much more room is devoted to corridors than is either necessary or to be desired.

Every square foot of corridor, &c., may be fairly reckoned as representing 20 cubic feet of building, which @ 1s. per foot=20s. When superfluous space at this price per foot is reckoned by hundreds and thousands of feet, the total is considerable, and I think worth serious attention as a factor in the cost of such buildings. But that is not the whole cost; for it must be borne in mind that every unnecessary square foot of space involves so much extra expense for maintenance and supervision—items which can be capitalized into a serious sum of money.

To make my argument convincing, it is necessary that I should show that inconvenient sites are responsible for the waste. I illustrate this by an example, and for obvious reasons I have chosen one of my own buildings. The St. Marylebone Baths, of which I show the Basement, Ground and First Floor Plans, stand on a deep, narrow and ill-shaped site. Adjoining is a plan showing how the building could have been designed upon the wider and shallower site which might have been secured if it had been possible to acquire the adjoining front land. The area of corridor in one plan is 3,000, and in the other 2,020 square feet. The revised plan occupies 630 feet less land.

I show also the plan of Plaistow Baths, the site of which was admirably adapted for economy in means of communication; and I may add that in this building the area of corridor per section is 143 feet only, and that the whole is under easy supervision from the offices. Another plan is that of Stratford Baths, in which the area of corridor is 423 feet per section. This is due not so much to the site as to the position of the entrances at one end. The area could have been greatly reduced if the entrances could have been placed in the side street.

By the courtesy of Mr. F. E. P. Edwards, the City Architect, I am able to show also plans of the Bradford new Baths. As they are even now only in course of construction, they should be designed upon the best and most modern lines.

The Corporation are adopting a general scheme for the whole city, comprising a large central bath and several small branch or local establishments. These latter are being designed and carried out by Mr. Edwards; and by no means the least excellence of the plans is the very small area devoted to corridors. The proportion per section is 70 to 80 feet only.

SERVICE CORRIDORS.

Not infrequently "Service Corridors" are provided, but they are a useless expense. It is always preferable to make it impossible for the Superintendent to go about the building without passing through one or other of the departments. The attendants are more likely to keep their sections in order if they are liable to be overlooked at any time of the day.

ENTRANCES.

In the older baths (and indeed it is the case with some modern baths), it was no uncommon thing to find four separate entrances for Bathers, one for each class of each sex. Nowadays, more frequently two entrances only are provided, one for each sex. In these democratic days when class distinctions are wearing down, there is less disinclination on the part of the

gentle classes to rub shoulders with their rougher neighbours. One Pay Office therefore suffices; whereas, under the former system, two at least were necessary. The services of a money-taker, or rather *two* are thus saved, representing at least £150 per annum in wages alone. Personally I have always advocated a common entrance for both sexes such as obtains at any railway station or other public building.

I should add that where a Bath is used for Public Entertainments, separate entrances should of course be provided.

Waiting Rooms.

Waiting Rooms to Swimming Baths are so little used that they would seem to be scarcely necessary. They are seldom, if ever really comfortable, and the Bath Hall always has superior attractions. In spite of rules and regulations to the contrary, Bathers generally crowd round the Bath itself and stand about the footways. This is, of course, exceedingly inconvenient and subversive of order. Is it not preferable to let Bathers in waiting sit or stand in the Gallery?

In some places there is a small charge made for admission to the Gallery, which, of course, does not carry the right to bathe. From the point of view of economy, a gallery would probably cost less than a waiting-room of adequate area.

Spray *v.* Slipper Baths.

Another move in the direction of economy is the abolition of the slipper bath in favour of the spray bath. It is scarcely necessary in these days to compare the merits of the two systems, although it is surprising to find how slowly the latter is replacing the former in view of its undoubted superiority. I will only here remind you of the features which recommend it on the grounds of economy, viz.:—It occupies just about half the space of the slipper bath, and uses half, or less than half the water necessary for the former. In an establishment of say 50 Baths, the saving in the structure and fittings alone wonld probably exceed £40 per Bath, or say £2,000, and supposing that each Bath was used on an average during the year three times daily, water would be saved to the extent of over 1,000,000 gallons, which at 6d. per 1,000 = £25, or the interest on over £800. To this must be added the saving in fuel, etc., in heating the water, and less cost of attendance. I believe that a well-appointed and arranged set of spray baths, each with its separate dressing-room, and with common warm and plunge baths, would attract better class Bathers in paying numbers. Well-equipped Turkish and Russian Baths at a moderate price should also prove paying departments. Special

or Medical Baths are probably more suitably attached to Hospitals or Hydropathic Hotels.

Attractiveness in Baths.

A great deal might be done also to make baths more attractive and inviting, and therefore more paying, by the study and application of the many little details which seem to appeal to human nature with so much greater effect than is the case with far more important matters. I may instance the circumstance of one particular bath in London which, as far as I know, is certainly not better planned nor decorated, nor better, nor indeed so well fitted as many others, and yet it is, or used to be, the most favoured bath in the metropolis. The only reason for its popularity appears to be that the whole establishment is tastefully decorated with growing ferns, which flourish exceedingly well in the warm moist atmosphere of a bath. The effect is certainly most attractive, and robs the whole building of the stiffness and cold formality of a public building.

It would appear that, in view of the great importance of inculcating the habit of frequent bathing, managers are justified in descending, if you so please, to the small art of making the habit pleasant and attractive at any cost.

I have been given to understand that the Corporation of this City (Bradford) have resolved upon allowing the use of their bath *free* on certain days to poor children. This is a movement which, I am sure, will be watched with a great deal of interest, and it seems more than likely, that, besides the immediate benefit to the children, the habit and love of bathing will be inculcated in a great many of them; and they may, later on, go to increase the number of regular bathers who pay for admittance, and thus help to make baths self-supporting.

Winter Bathing.

It seems a great pity that swimming baths in this country can only be kept open during six months of the year. In some establishments at least one bath is kept open all the year round. This is only possible by keeping both bath and hall well heated, though this may be, and frequently is, overdone. Even so, they are poorly patronised, and it would appear that something is still wanted to attract bathers during the cold months.

Intercommunication.

It is desirable that all the warm baths should be as close together as possible. I remember, some time since, reading the description of a design in which the Author in effect drew attention to the fact that every section

of his scheme was carefully separated from every other, so that there could be no communication between them. I refer to this description merely because it represents the very antithesis of what should be the Architect's aim in the arrangement of baths. I should add that his plans showed the warm baths arranged at *three different floor levels.*

The only divisions required are, in the first place, for the separation of the sexes (and this should commence from the General Entrance Hall), and secondly, separation of the classes, which need only commence at the Waiting Rooms immediately adjoining the baths.

Referring to the plan of the St. Marylebone Baths, I will draw your attention to the arrangement of the Warm Baths, which most nearly approaches the ideal I have in my mind. You will see that the First and Second Class Bath sections in the case of both Men and Women are divided by doors only, so that each set is, in a way, interchangeable, and by this arrangement, a minimum number of attendants is required, and in the slack hours, one only would be sufficient for both classes of each sex.

Bath Attendants.

The work of a Bath Attendant is peculiar in many ways. His energies are used in a very unsatisfactory manner. As a Bath Attendant he may be very busy for two or three hours in the day, and for the remainder he has little or nothing to do. He fills in his slack time by cleaning and polishing the baths and fittings under his charge, and if he is in charge of a sufficient number, he will be well employed most of his time. But his general employment varies according to the season of the year; and if the number of attendants on duty is calculated for the busy season of the year, it follows that at other seasons they cannot have sufficient to do to keep them fully employed. As a consequence they are likely to get into that worst of all habits, lounging.

In human labour, as in machinery, the best results are obtained by steady and continuous work, though comparison fails when we reckon the length of time each can work on end. It is customary to employ these men for a number of other duties, especially that of repainting and general cleaning work which is required so continuously at public baths. This employment unfortunately is much resented by thorough-going trade unionists, and nowadays, on public boards, we have to reckon with Trades Unionist feeling.

I fear that I cannot suggest any other remedy than that of endeavouring to convince those who hold as a fetich the ideal of "one man one job" that there are employments in which it is folly and sheer waste to apply this rule; and that a bath attendant's is one of them.

ENGINEERING.

One of the most important parts of a bath scheme, especially from the point of view of economy, is the engineering system. The boilers and engineering works generally should be of the best description and designed on the most economical lines for the highest efficiency, and by this is meant commercial efficiency, and it is better to reorganize, if necessary, the whole of the engineering plant of an establishment, even at considerable cost, than to waste power and fuel year after year with inferior plant. Americans regard the high efficiency of machines as a matter of first importance; and I have been told that it is no uncommon occurrence for an American manufacturer to throw out of use a costly machine, which has been erected a few months only, on finding that some machine in the market will do a small percentage more work. But then, Americans above all people, understand the enormous value of small margins of profit.

Engineers tell us that every ton of coal of standard quality is capable of producing a certain number of units of heat, which again can be converted into a definite number of units of force; and the aim of every good engineer is to obtain the maximum in both cases. In the case of heat, it is to this end that boilers are carefully designed, and should be improved or kept in the best order from year to year. Records should be kept from day to day of the amount of steam produced and coal used, and when the proportion between the two begins to fluctuate, it may be taken that either the coal is bad or that the boiler or some part of the apparatus is at fault.

This also applies to the engineering system generally; by which I mean that it is quite possible to reckon what power is required to do certain work, and to judge from time to time whether the work is taking more power than it properly should. It is certain that wherever this system is adopted a considerable saving must be made in coal consumption and renewals of machinery; and also that the efficiency of the buildings is greatly increased. The work can scarcely be done scientifically by the working engineer; although I believe that many, if not most of them, do use their judgment in this way in a rough or rule of thumb manner.

I venture to think that it would pay most municipalities to employ a special statistical officer to organise a system of engineering accounts for each establishment, and to check, from time to time, the results obtained from the fuel consumed.

There is not room within the limits of this paper to deal in detail with other matters of construction, but I have no hesitation in asserting that there is much room for economy in many directions.

Owing to the excessive wear and tear upon all fittings, it is a matter of great importance that everything should be of the most substantial construction. The unavoidable moisture in the atmosphere in bath buildings necessitates glazed or other impervious surfaces for the walls and floors. The importance of absolute cleanliness in every part of the establishment calls also for the avoidance of all angles, mouldings and other repositories for dirt, as much as if the buildings were for hospital purposes. These contingencies generally involve the use of costly materials and construction, but there is a tendency to run in grooves in the use of well-known materials and forms of construction. I am confident, however, that a good knowledge of the qualities of materials, combined with judgment and the courage to be original, will enable a bath designer to effect large economies in these matters. It is essential that he should, in the first place, make himself acquainted with the habits of bathers, the peculiar conditions of these buildings, and the general working arrangements, all of which can be learned in consultation with any willing and intelligent superintendent. Solidity and simplicity in construction materially affect the question of first cost, and to an even greater degree, maintenance charges.

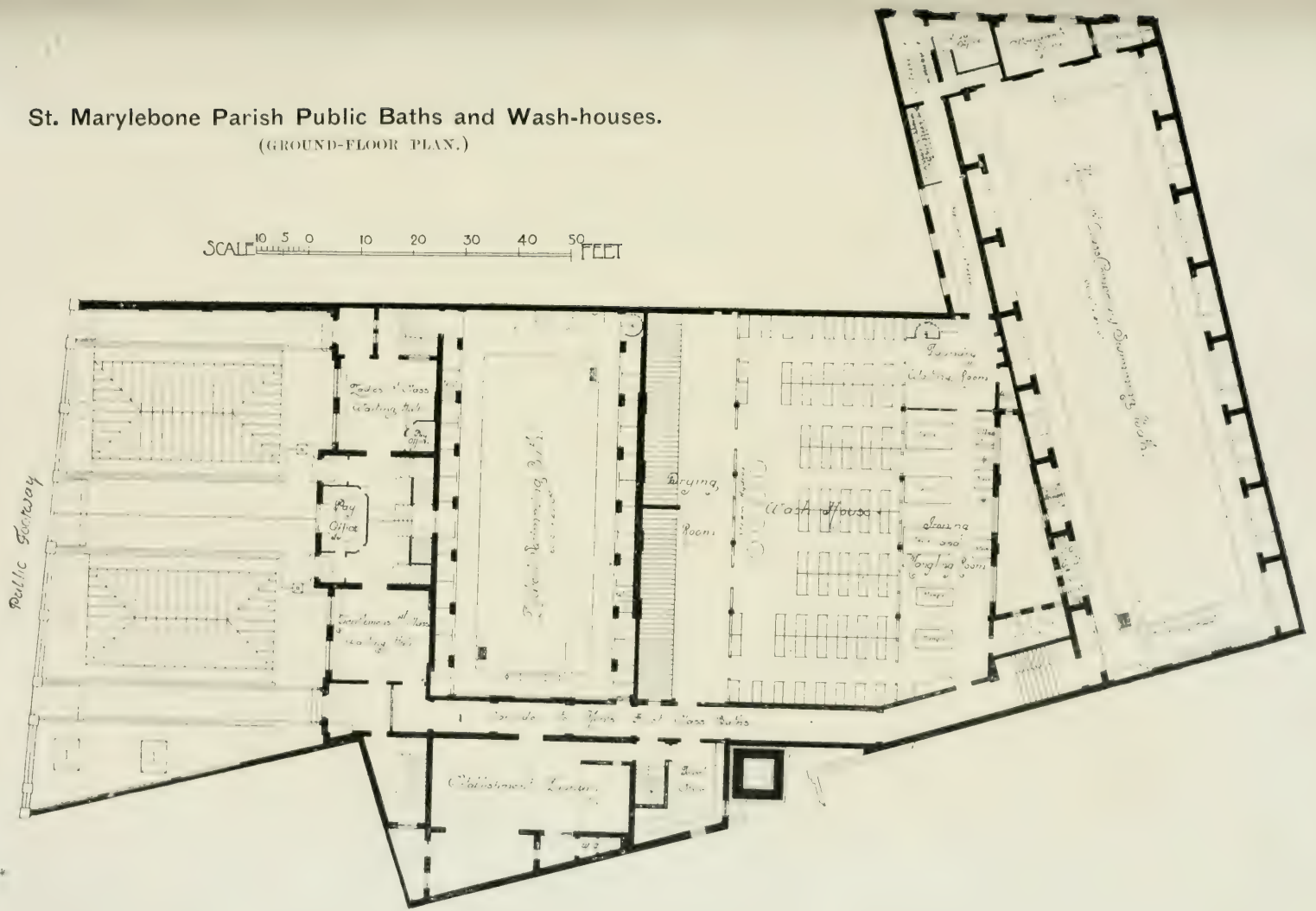
In conclusion, it is necessary to add that it is not claimed that the economies to which I have drawn attention will alone render these undertakings remunerative, but they will go a long way towards that desirable goal, and tend to encourage municipalities to still further extend the area of their usefulness.

W. Chapman Field (Borough Architect and Building Surveyor of Eastbourne) said that it seemed to him that the wisest thing would be to make the deepest part of the bath some distance from the extreme end, because a diver would not really come near the bottom of the bath till some yards from the end. Would it be practical to make the bath as he suggested? He wished also to hear Mr. Snell's opinion as to what was the best means of keeping up the heat of the water in a swimming bath; whether by injecting steam into the water or a system by which the water circulated through a hot cistern and back again into the cold bath, or what system he considered the best. If a bath was used in winter and the weather was cold, there was sure to be some fog in the bath room. Could any means be used to prevent that, except heating the bath-room itself?

Councillor Upson (Chairman of the Health Committee of Maidenhead) said that the great point about public baths was how they could be most

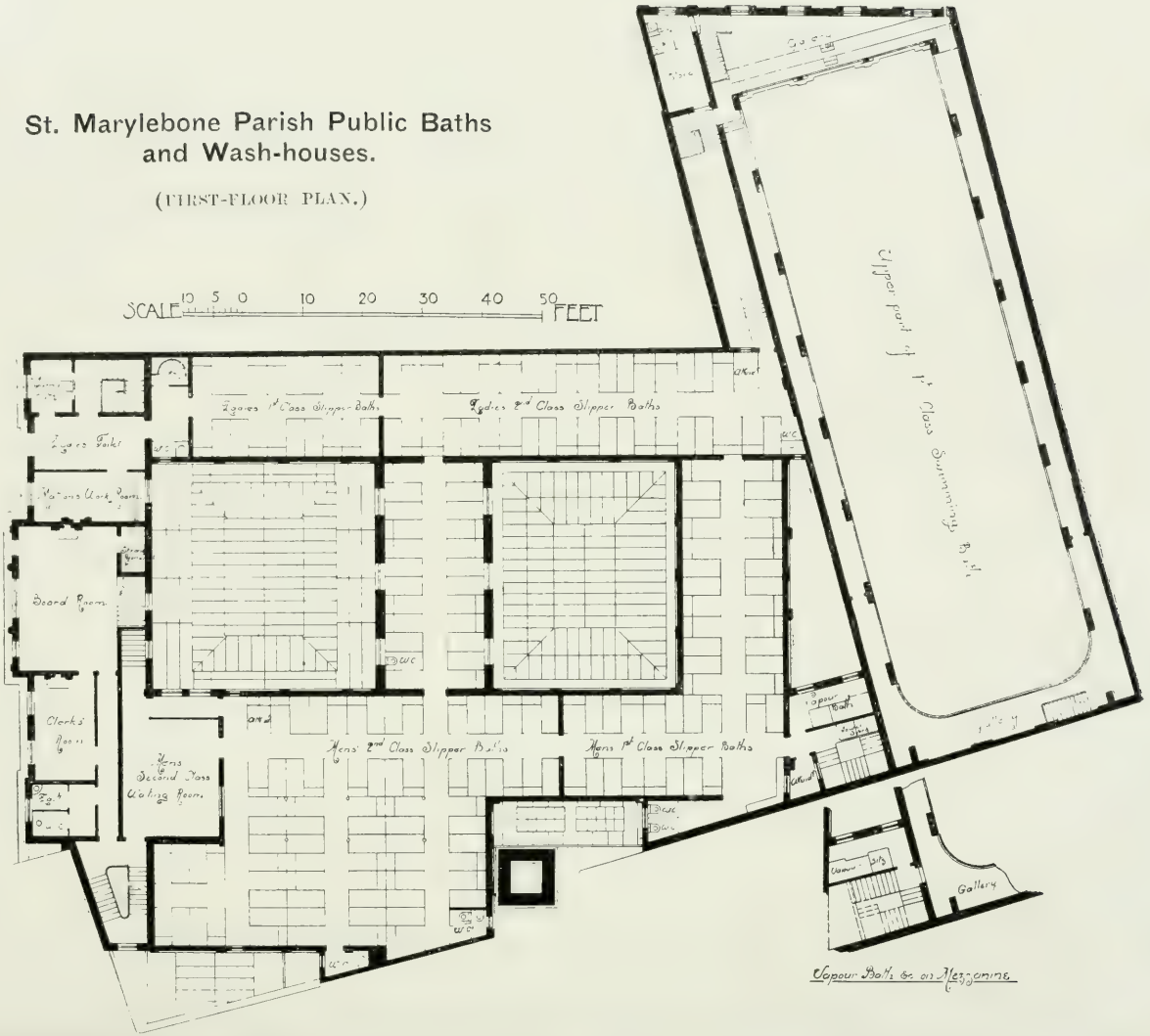
St. Marylebone Parish Public Baths and Wash-houses.

(GROUND-FLOOR PLAN.)



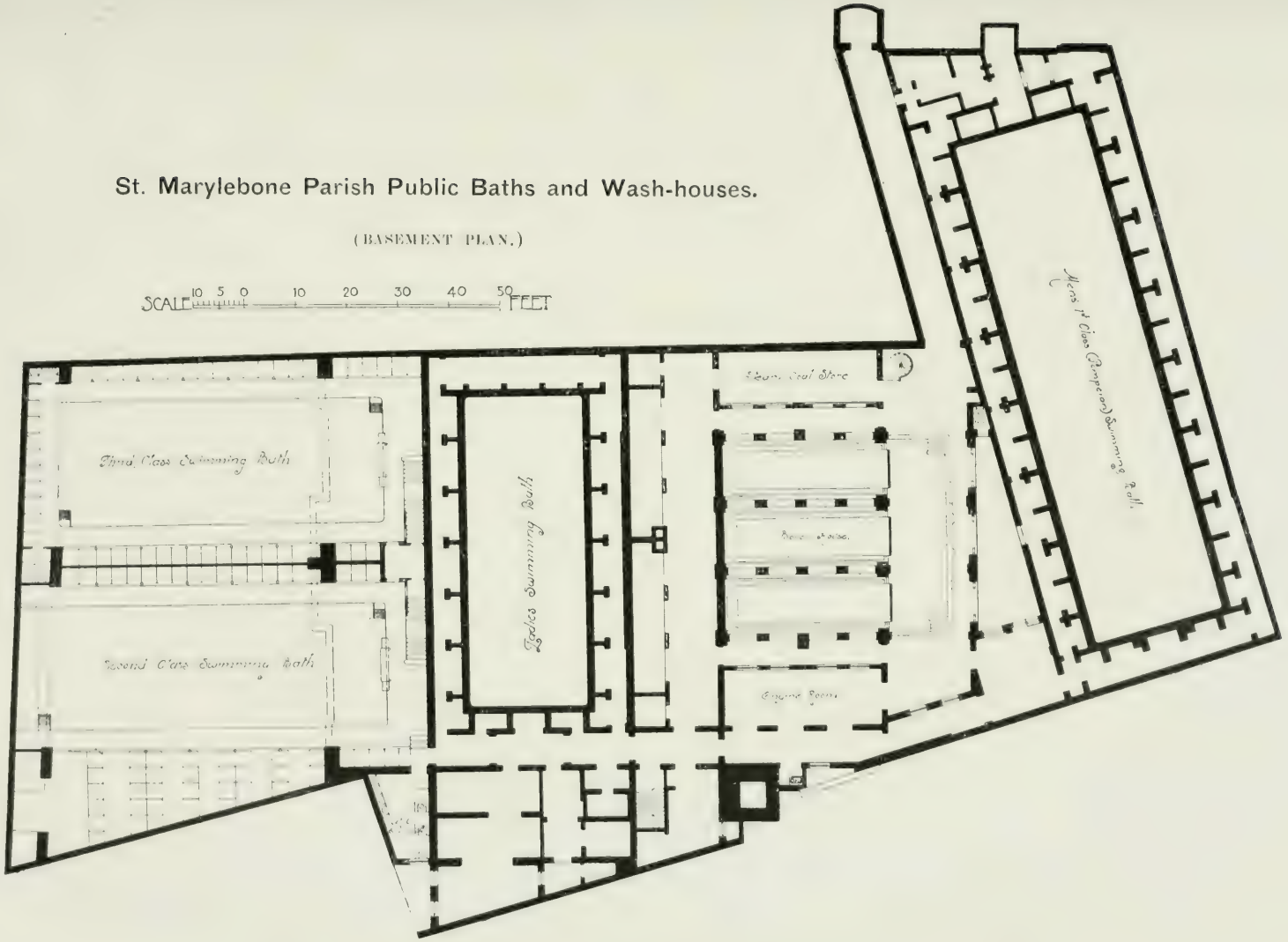
St. Marylebone Parish Public Baths and Wash-houses.

(FIRST-FLOOR PLAN.)


SCALE 10 5 0 10 20 30 40 50 FEET
Ladies 1st Class Slipper Baths
Ladies 2nd Class Slipper Baths
Ladies Toilets
Matrons Work Room
Board Room
Clerks' Room
Mens Second Class Waiting Room
Mens 2nd Class Slipper Baths
Mens 1st Class Slipper Baths
Upper part of Plunging Bath
Vapour Baths
Gallery
Vapour Baths on Mezzanine

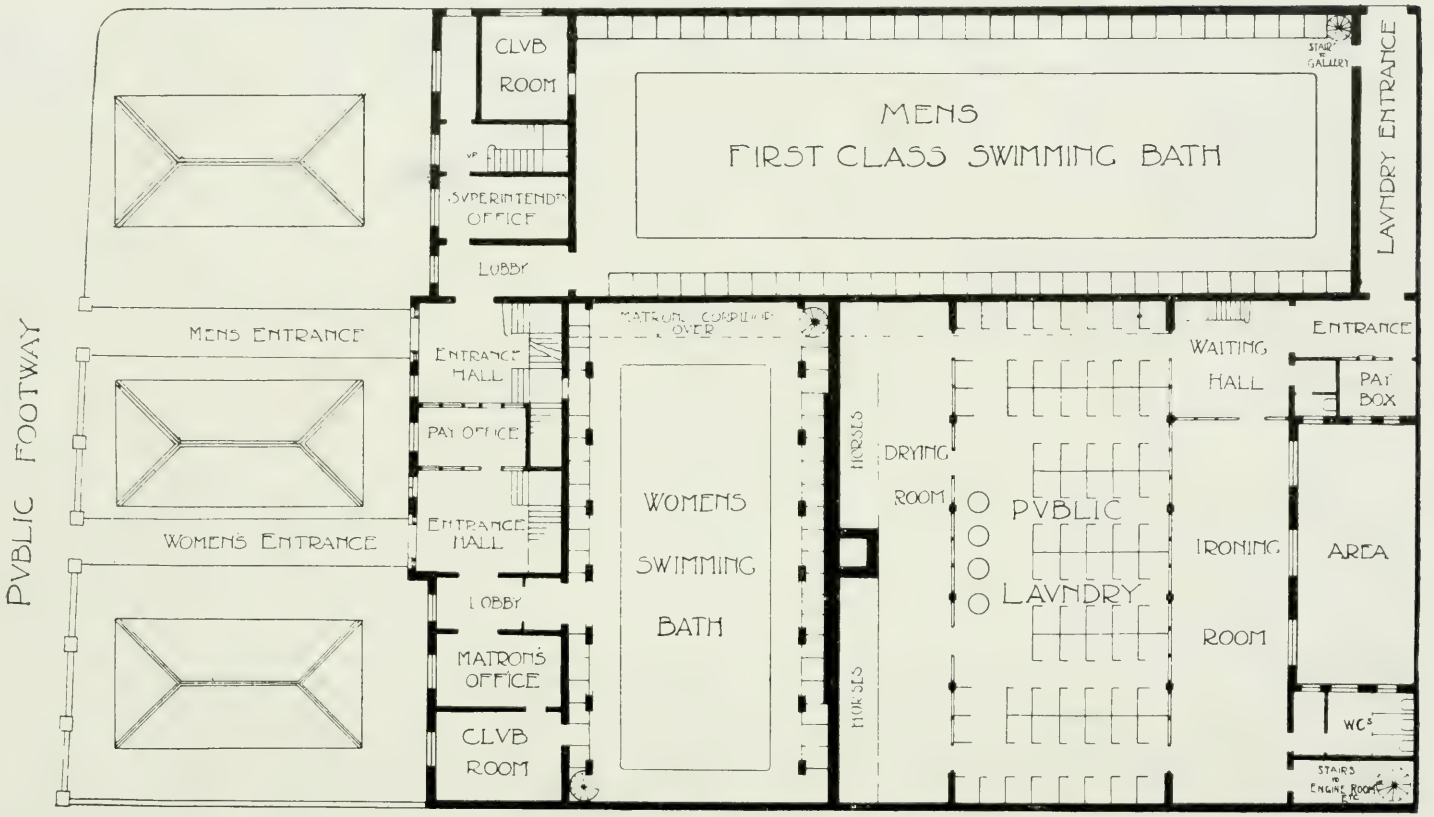
St. Marylebone Parish Public Baths and Wash-houses.

(BASEMENT PLAN.)


SCALE 10 5 0 10 20 30 40 50 FEET
Third Class Swimming Bath
Second Class Swimming Bath
Ladies Swimming Bath
Men's 1st Class (Emperor) Swimming Bath
Engine Room

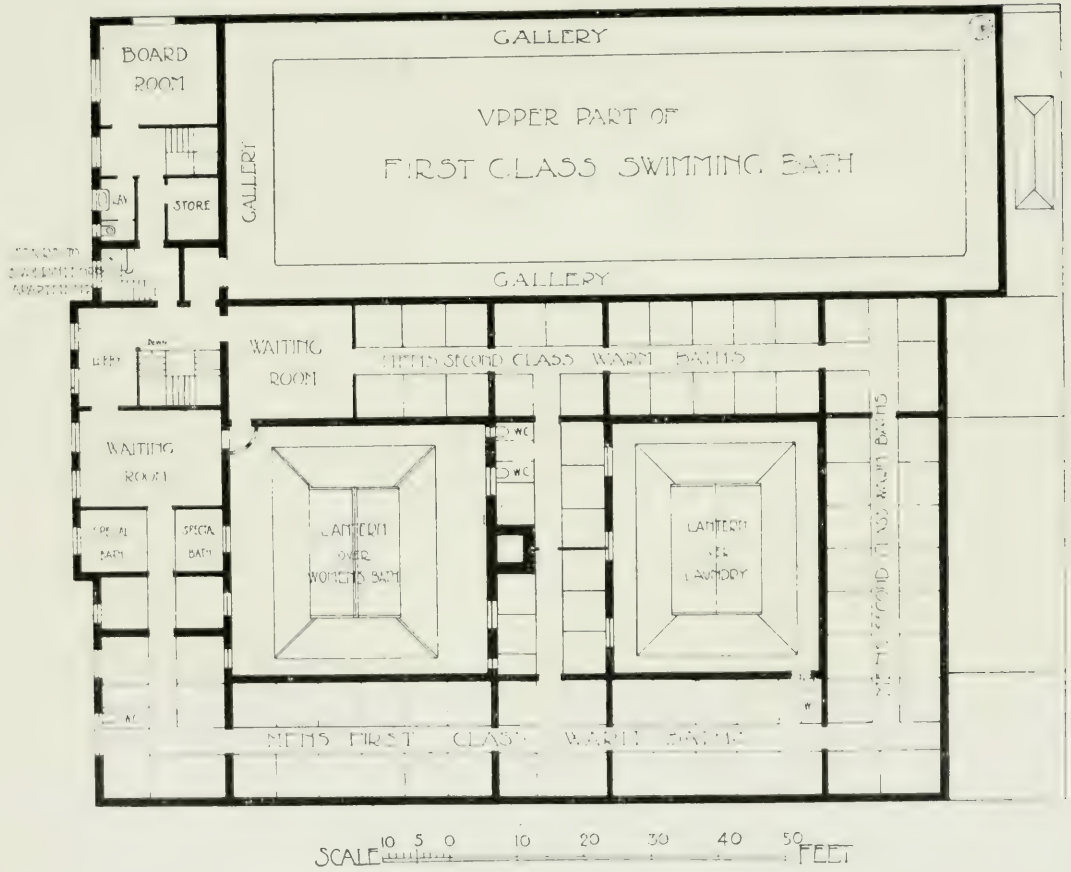
St. Marylebone Baths and Wash-houses. Revised Plan for Rectangular Site.

(GROUND-FLOOR PLAN.)



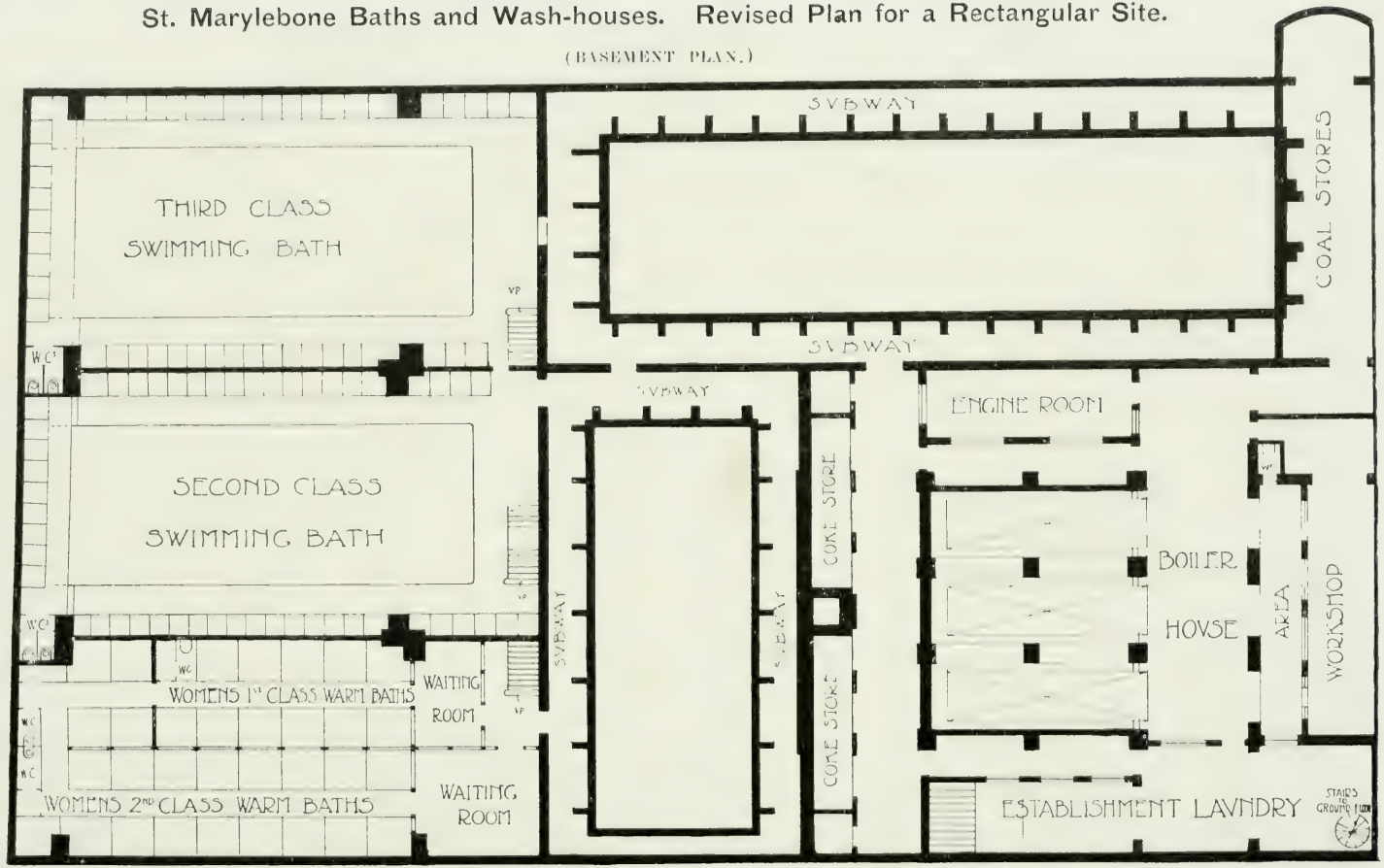
St. Marylebone Baths and Wash-houses. Revised Plan for Rectangular Site.

(FIRST-FLOOR PLAN.)



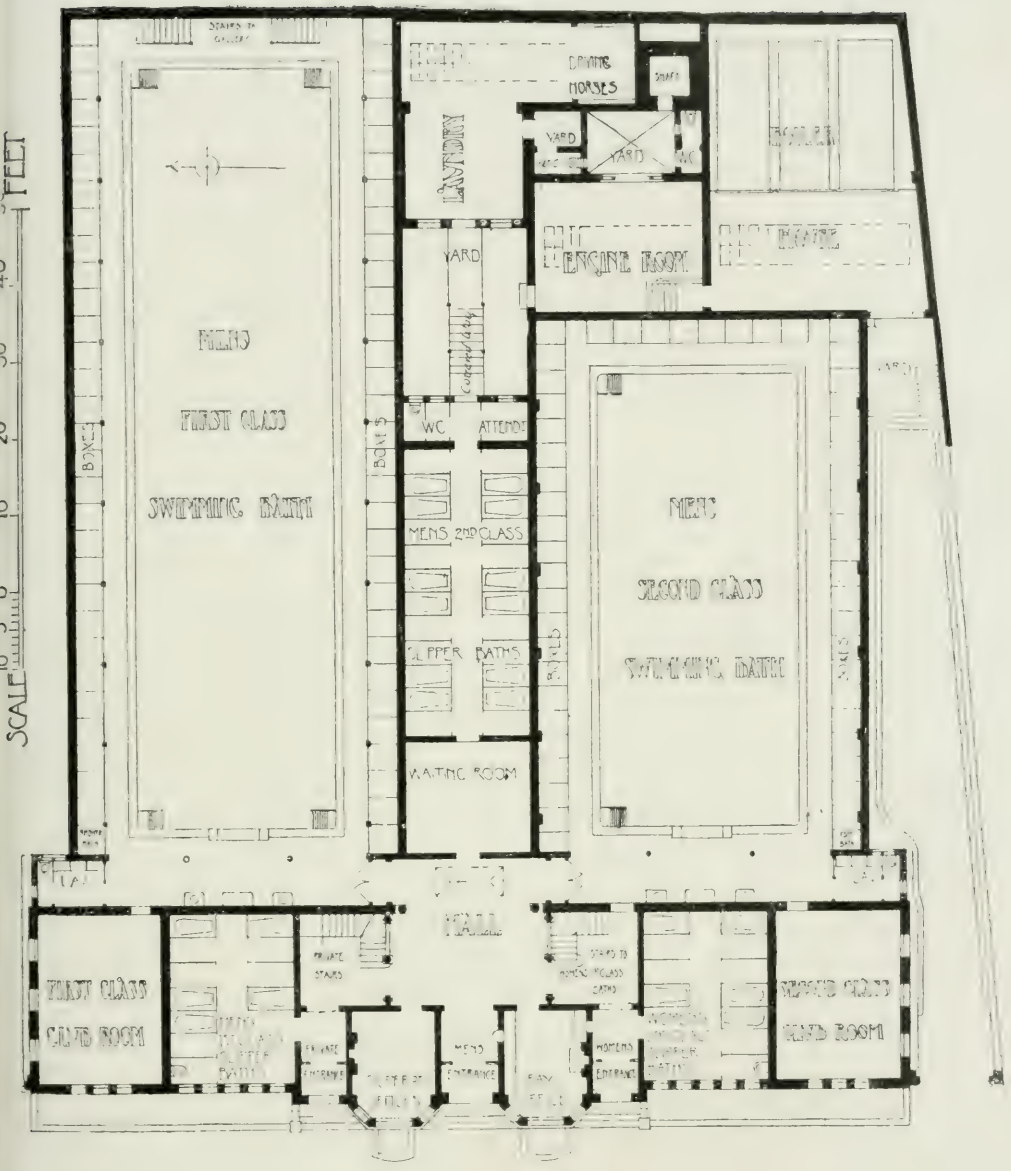
St. Marylebone Baths and Wash-houses. Revised Plan for a Rectangular Site.

(BASEMENT PLAN.)



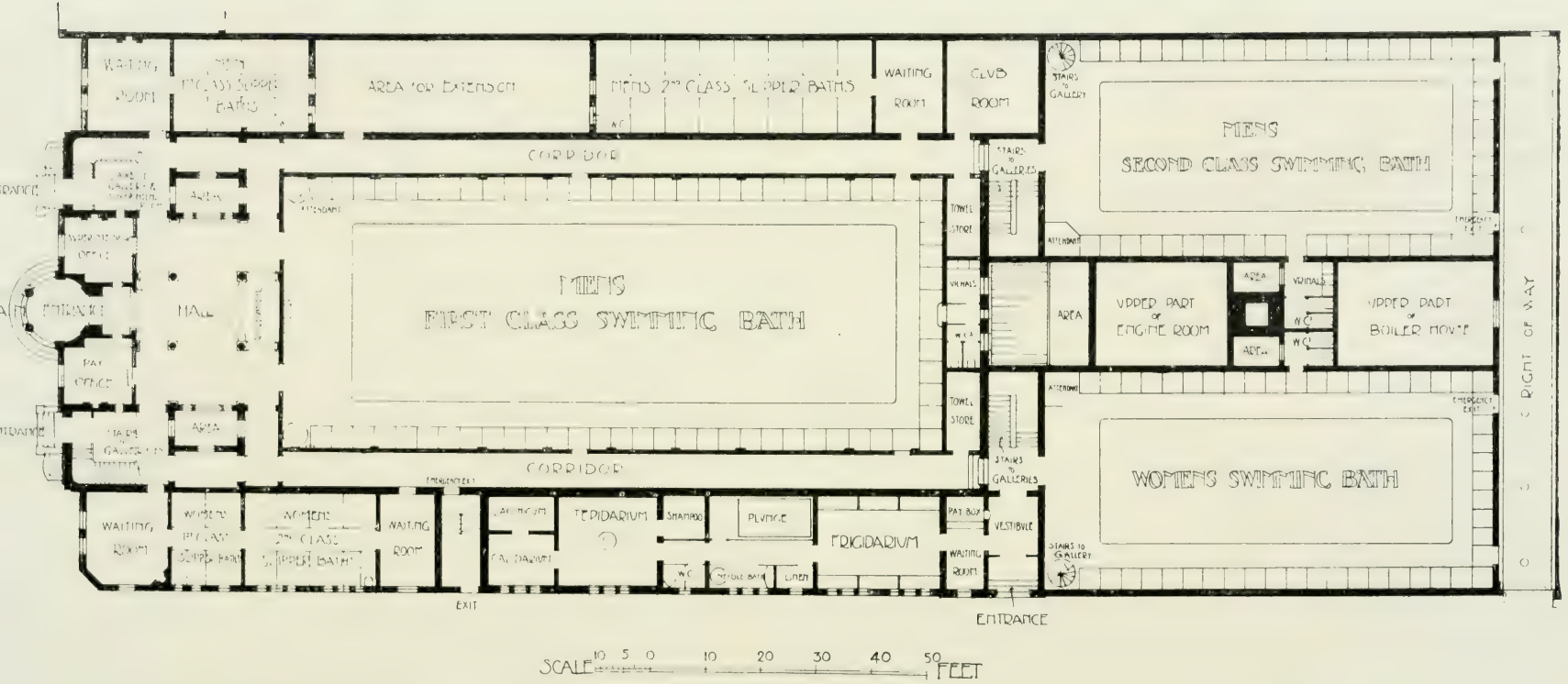
Plaistow Public Baths.

(GROUND-FLOOR PLAN.)



NOTE.—The Superintendent's Rooms and Board Room are placed over the front centre portion. Stores in Basement.

Proposed Public Baths, Stratford, E. (GROUND-FLOOR PLAN.)



economically heated. His Council sent him on a pilgrimage to visit baths and find out the best method of heating, and, after visiting a great number, he had not been able to decide on the best method of heating. The men in charge seemed seldom to have considered the point. They were mostly happy-go-lucky individuals, content to make the best of the bath they were working. Municipal baths, apparently, were not run as business establishments. To make them profitable the baths should be cheapened as much as possible. He was glad to hear the spray bath recommended instead of the slipper bath, for it was less costly, and the cost of a warm bath ought not to exceed 2d. Workmen could not afford to pay more, and if a higher price was charged they would not use the bath. Now in many cases the charge was 4d. or 6d., and he found one large corporation gave a slipper bath for which customers had to pay 8d. Such a price was prohibitive. He believed that a spray bath at 1d. could be made to pay well. It would certainly be desirable to have the deepest part of a swimming bath about ten feet from the end, with a graduated incline to the ends. This had, he believed, been carried out at Shoreditch and West Bromwich.*

MR. F. E. P. EDWARDS (City Architect, Bradford) said that the point of view of the Bradford Baths Committee was that they should make the baths if not actually pay, at least as light a burden as possible upon the community. In regard to the question of sites, he believed that Mr. Snell intended his criticism to apply mainly to the Metropolis. Speaking as one generally responsible for the baths in Bradford, he ventured to say that they had admirable sites, which he found ready to his hands to make the best use of. They were well chosen, and surrounded in most cases by streets of an important character. It was interesting to hear what Mr. Snell had to say about the economy of avoiding an excessive amount of corridors in the plans, and he was also interested to hear that Mr. Snell did not object to means being provided for persons to pass from one department to another, provided that means were taken to separate the sexes. In regard to the douche baths, which were being largely adopted in Bradford, he wanted to ask Mr. Snell whether he was in favour of the rose douche or the ring douche. Then there was the very important question of valves, which in the Bradford baths were to be under the control of the bather. It was hoped arrangements had been made so that there was no possibility of the bather being able to scald himself. This was important both for the sake of the security of the bather himself and also to prevent the Corporation being mulcted in damages. There was one question which they had found to affect them adversely in Bradford—that was the colour of the water. The Bradford water was drawn from the moorlands, and, though it was excellent in quality and in small quantities perfectly clear, when it was taken in bulk, as in a swimming bath,

* An arrangement of inexpensive spray baths is described and illustrated in Vol. X., page 230.

there was a certain peaty matter in it which gave a brown tint. It had been suggested by the Chairman of his Committee, whether some means could be devised either by the use of coloured tiles for the lining of the ponds instead of pure white, or some other expedient, which would have the effect of counteracting this discolouration. This could of course be attained by the provision of a filtering plant, but the additional expense was a serious consideration. He thought this was an interesting point on which he should like to hear the opinion of the experts present. In regard to the point of making the deepest part of the swimming bath some distance from the deep end, that was a custom which was always adopted in the construction of a modern bath. Both the baths which were being erected in Bradford now were designed in that manner, being more economical from all points of view.

Councillor H. M. Trotter (Chairman of the Baths and Team Labour Committee of Bradford) said that it had been remarked by Mr. Snell that baths were costly and did not pay—in fact were not expected to pay. He would like to inquire whether in his experience Mr. Snell knew of any public suite of baths in the United Kingdom run by any municipality which was making a profit. The baths had not been pushed forward in Bradford with any idea of their being able to make a profit, for they showed indeed a loss. He was pleased to say that the Corporation had within the last three or four years, during which he had been chairman of the Baths Committee, realised the fact that they must look not to cash profits, but to the better health of the people for satisfactory results from their baths. The expense was really small in comparison with the advantages given by them. He was delighted to find that the policy which they were following in Bradford was in many ways in agreement with the suggestions of Mr. Snell.

Mr. Alfred Saxon Snell (London), in replying on the discussion, said that most modern baths were now built in the way suggested, with the deepest part of the bath from seven to ten feet from one end, and the bottom was sloped to this depth from both ends. The outlet was placed in the deepest part. He had heard of a bath in which the bottom was sloped at two different gradients. From the shallow end the slope was gradual to about the middle of the length, from which point it inclined sharply to the deepest point. Boys and non-swimmers could thus use a larger area of the bath, and the saving in water would be considerable. With regard to the heating of baths he had still "an open mind." He had used circulating pipes taken from the deep to the shallow end, and in which were inserted steam injectors. More economical results might be obtained by circulating the water through a large heater or calorifier, by which means the steam as condensed was returned to the boiler. He was glad to hear from Mr. Edwards that Bradford was so enlightened as to choose good and prominent sites for its baths. With good sites the architect was able to

design buildings which were both economical and useful. The ring douche was specially advisable with cold douches because it protected the head from the impact of cold water descending upon it, which was not pleasant. With respect to the peaty colour of the water of Bradford, he was glad to say they were not troubled with that difficulty in London. But in a general way it would be found that a certain number of dark blue tiles had an enlivening effect, and with the brown water of Bradford the effect should be distinctly good. To the best of his knowledge public baths did not pay. Bradford was, he believed, doing a wise thing in starting *free* baths for school children, because they were by this means providing a "clientèle" for their baths in years to come. The only way to make baths pay was to encourage people to bathe, and the more they could do this the better.

EVIDENCE AS TO THE CAUSE AND EFFECT OF THE LOWERING OF THE PERMANENT WATER LEVELS IN THE LONDON WATER BASIN.

By CLAYTON BEADLE, F.C.S.

THE substance of this paper will merely embody the opinions as expressed by various authorities abstracted from one or two well-known publications. I shall make no attempt to express my own opinion on the subject, nor do I desire to represent the case in a way which would favour my own opinion.

There are manifold causes which contribute to the lowering of the permanent levels, but these can only be briefly alluded to.

Limitation of Area.—Only that portion of the water which falls within a certain area, more or less defined, and involving a consideration of underground as well as surface geology, can contribute to the London Basin. This area is far more restricted than the area of the London Basin itself. The overlying Thanet Sand having been exhausted, the Chalk remains as the chief if not the only practical source of supply for deep wells. It is only the Upper Chalk which can be considered as possessing any storage capacity for water. That portion of the London Basin covered by impermeable beds, more particularly that which does not drain towards the Chalk, is not available as a catchment area, and furthermore the overlying Clay has so compressed the chalk as to impair its qualities as water-bearing strata. That portion of the rain falling upon impermeable beds draining to the Chalk contributes to some extent to the underground supplies. There is a further area covered by mixed beds, the permeability of which is unknown. Of that which falls on permeable strata overlying the Chalk, or on the bare Chalk, only a portion percolates to the underground sources of supply. This percolation is variable according to the time of year and varies with different years. The circumstances and

conditions which bring about this variation are too numerous and complex to discuss here. Generally speaking it may be said, however, that about nine tenths of the percolation takes place during the winter months, and only one tenth during the summer months. On an average soil of the Home Counties about a third of the total rainfall may be considered to reach the underground waters, the rest having evaporated, or in some instances passed off into the river. Percolation in some years is as small as 3 inches of rainfall out of a total of 20 to 25, in normal years as much as 7, but in excessive years it has reached 10. Inasmuch as the underground waters are not standing still but are in constant motion, and leak away, and the leakage is greatest as the result of wet years, and that the effect of wet years is soon obliterated, such provision should be made as would ensure that no greater amount is taken than can be supplied by percolation during a succession of the three driest years, during which the rainfall is about 20° below the average.

Our modern system of drainage has resulted in the diversion of a large amount of water, which in dry weather amounts to about 200 million gallons a day from the metropolis, and at storm time to 400 million gallons a day, finding its way into the river Thames at Crossness and Barking. This amount of water would naturally, if not diverted, have fed the soil. The direction of the underground water current mostly follows that of the rivers, being determined partly by surface and partly by underground geology. It has been suggested that the river valleys in the chalk indicate a much damper climate than at present, but modern views do not necessitate this supposition. The river beds and consequent direction of existing rivers appear to have been determined by conditions which prevailed before the Glacial period. The direction of underground waters largely follows the inclination of the geological beds, but in a large measure that of the river beds, and is very complex. In those districts where the dip of the strata and direction of the rivers is the same, the underground water has a twofold tendency to travel in the same direction as the rivers. Much of the underground water appears to find its way into the bed of the River Thames at low tide, and from evidence it would appear that some years ago the underground water leaking into the Lower Thames was equal to if not greater than the amount pumped from the Chalk for the supply of the metropolis. Although the Thames at points, such as at Erith, appears to receive large quantities of underground water, there is evidence that parts of the Upper Thames are depleted by pumping in its vicinity, and the shrinkage of the Thames and Lea as measured up to the end of last year is in part attributed to that cause.

Years ago the overlying Thanet Sand afforded water to the metropolis, but on account of its small outcrop and thinness it became practically exhausted. Wells were then sunk deeper into the Chalk. The Chalk, where covered with clay or other beds, is more compressed, and as a consequence contains much less water, and the clay acts as an impermeable barrier to the rain.

Attempts to obtain water from the Lower Greensand have proved failures, and the formation has been found not to exist under London in many places.

In 1828 the eight Metropolitan Water Companies supplied the metropolis on an average with 29 million gallons a day. Now they are supplying at the rate of about 217 millions, being between seven and eight-fold what it was in 1828. At the former date the amount pumped from the Chalk was only about a quarter of a million gallons a day, now it is about 54 millions.

1,650 private wells are known to exist in London, but the average amount which they deliver a day is not known. As 65 of these wells, sunk by a well-known Engineer, show an available pumping capacity of about 10 million gallons a day, the aggregate amount must be something enormous, and probably much in excess of that pumped by Metropolitan Water Companies.

It has been estimated by one who claims to have exhaustively studied the subject, and who clings to the view that the water under London is practically inexhaustible, that there are 1,000 private wells in the London Basin lifting on an average 100,000 gallons each daily. This would give an aggregate of 100 million gallons a day, and would lead us to believe that the total aggregate pumping and leakage represent a total loss to the London Basin of upwards of 200 million gallons daily.

Unofficial returns made to me of the total water consumption per ton of manufactured product, and the amount of output of certain of our manufactures, would suggest that our manufacturers are drawing enormous quantities of water from the London Basin, and that the above-mentioned estimate is by no means an exaggeration.

In 1893, 172 chalk wells were estimated to yield about 10 million gallons a day, and the number of wells were said to be greatly on the increase.

In places where, 100 years ago, the water when tapped would rise to the surface and overflow, the level is now over 100 feet below ordnance datum.

In 1850 the permanent levels were depressed from 50 to 60 feet at

the lowest point, the depression having been noticed thirty years previously. In 1850 the level was falling at the rate of one foot per annum. In 1893 the fall was variously estimated at between 12 and 18 inches per annum.

It has been estimated that the levels are lowered to such an extent in Hertfordshire that if the pumping was discontinued it would take forty years of rainfall to make the levels up.

If no water were removed by artificial means and no rain fell the levels would fall in consequence of the perpetual natural leaking away. A large proportion of the rainfall is required merely for maintaining the water level. It is only the excess over and above what is necessary to do this that can be artificially abstracted without permanently depressing the levels. The so-called level of saturation is the point at which water will rise in a well, but the actual water in the Chalk gradually grades off from the water level upwards.

The effects of depression were prophesied in 1876, and recent events recorded in evidence show the truth of this prophecy.

In conclusion, I would merely refer to the effects of a permanent lowering. The drying up of streams, springs, shallow wells, loss of power from streams, drying up of watercress beds, loss of fishing, additional cost to manufacturers consequent upon having to deepen wells and raise all water from greater depths, the dying of deep-rooted trees, loss to landscape, loss to farmers and agriculturists. But what would probably concern the Sanitary Congress most would be the danger of pollution of sources of supply through infiltration of surface and contaminated water, more particularly perhaps in chalky districts where water passes by means of fissures.

Finally, assuming that the conditions are such as to occasion further depression, if the same be prolonged the time must come when the water supply, even from the wells in the London Basin, will fail.

CREMATION VERSUS BURIAL.

By W. HOLDER, M.R.C.S.

I WOULD desire to say that we, as sanitarians, are responsible, as each one individually is, for our own part. Let me read an extract from some writings of Dean Church. It runs thus :—

> "We are like soldiers in a widely extended battle-field, of which we know not the phases, of which we seem utterly powerless to control its issues ; but we are responsible for our own part. Whatever goes on elsewhere, let us not fail in that. The changes in the world, which men think they are bringing about, are in the hands of God; with Him, when we have done our duty, let us leave them."

The object of this Congress is to unravel some of the sanitary difficulties of the problem of the widely extended battle-field of disease, of which the most expert know not all the phases. The microscope has shown the minute form of some germs of disease, yet their genesis, their life history and power for evil under unknown phases, are, up to now, not a demonstrated proof. Yet we know enough to see that the buried germ is not a dead danger ; that through worm, mosquito, fly, wind, or rain wash, it may, years after interment, awake to spread its malignant disease. What, then, is our duty, if not that we shall act the part for which, with knowledge in our possession, we are responsible? If we recognise this, then the members of this Sanitary Congress will support Cremation at every opportunity.

The steady progress of sanitary precautions has materially lengthened the prospect of life, and lightened the costs of the life-risks of insurance companies. The substitution of Cremation for burial will continue the struggle for health against disease, helping our workers and increasing their chances of happiness. The working men of Hull have the credit of being the first of their class to show England that they recognise the advantages of Cremation, not only have they at the meeting of delegates unanimously approved of this, but one of the members of a friendly society, a dock labourer, requested his club members to see his body was cremated. At his death his desire was obeyed.

Cremation is now beyond its experimental stage. Whether you approve of its principles or not, you and I are under the deepest obligation to it. For instance:—during last year several cases of plague came in a ship to the port of Hull. In this plague attack all but one died. In plague cases, from health to death is but a question of a few hours. The tissues of the victims were saturated, in lungs, blood-vessels, and glands, with the infective germs of the disease. If the remains of these plague infected bodies had not been quickly cremated it is not unlikely the disease might have broken out in Hull, and from thence be sent to Bradford and other inland towns; hundreds of lives might have been sacrificed, and the trade, of the cities infected, permanently injured. It is nothing but fair to credit Cremation with the important fact that within an hour or so, the diseased tissues of these unfortunate men were deprived of all their malignant infection, were innocuous, pure, white, calcined remains which could have been handled with impunity. Who can say that a plague with its sequences of devastation and expenditure was not thus stayed? Such is a national as well as local evidence of the value of Cremation to humanity.

The objection to Cremation can only come from those who will not think out the horrors of burial of bodies.

For sentiment's sake compare Cremation with earth decay by burial. In Cremation, within an hour the vapours and gases have evaporated into the air, and the whole solids of the body are left as clean, pure, sanitary ashes. Compare this with the sloughy putridity, full of infective germs, of a buried body after one, and sometimes after seven and eight years of burial and then ask what can be your verdict of the two systems? It must be, if you reason at all, that one follows the laws of science and wisdom, whilst the other is unworthy of—nay, it is not generally followed by—savage nations.

Cremation is more to the benefit of workers than that of any other class. Their health is their strength—Their strength their wealth—Their wealth is, or should be, their comfort. No man should be poor who is strong. The success and future happiness of those around men depends on their health. The savings of a vigorous healthy life should bring comfort and support to old age and declining years. Vigorous healthy surroundings then are their necessity. How will burial prevent this blessing? How will cremation make it possible? This is not difficult to explain. You have all here an intimate knowledge of "Disease Germs." It is easy to show microscopically the different forms of spores, bacilli, and bacteria of specific disease infective germs—a body dead of typhoid has the bowels swarming with these germs. It is now recognized that not only the

germ, but also their exuded toxic poisons carry diseases. The drainage from Cholera graves has several times re-awakened Cholera. Yellow Fever and Anthrax have been propagated from the soil in which bodies dead of these diseases were buried. Here we have evidence that earth burial tends to deprave health. Ought we not to see if there is not a better method to prevent it? The refining influences of heat have removed for all ages dross from the precious metal, and so it can from diseased tissues. Cremation clarifies and refines the diseased dead, kills the germ threatening health, and thus lessens the dangers from diseases with their attendants weakness and poverty.

If we can, then, by discontent with burial, which is crude, unclean, and disease-giving, end it, and by discontent bring Cremation, with its purity, perfect cleanliness and reason, we shall displace that which makes for disease and restore that which tends to the uplifting of health with its attendant blessings to mankind. This is a task worthy even of this important Congress.

Another attendant danger on burial is the gruesome graveyard with its straight-edged tablet. In its prime it is a resort of woe, in its age often an oasis of neglect. In Hull, dockers have been rendered sick and ill when working 100 yards from a graveyard. The dry heat of summer cracked the earth, and the gases poisoned the air.

One of the benefits of Cremation is that it will effect great saving of land waste, especially in towns.

Having shown these benefits from Cremation, I have the right to say that by the Cremation Act of 1902, the Legislature has done nothing to encourage but to retard its progress. I claim the sympathy of this Congress to this complaint.

Hindrance offered To Cremation by Unequal Laws.

It is not so much that the Cremation Act of 1902 is unnecessarily searching and severe as it is that the disparity under which Cremationists are placed compared with those who practice the unsanitary method of earth burial is so unjustly enlarged by this enactment.

It is an astounding statement, but not less a true one, that to bury a dead body no legal regulations exist, but on the contrary to cremate a dead body legal requirements, unnecessarily expensive, have been, by this Act, imposed. This is a disparity and a wrong which this Congress, in the interests of public health, is urgently invited to put right.

It will have given most of you, who have heard so much lately of the

legal argument against Cremation, a shock to learn that *not one legal formality is required to procure the burial of a dead body*: this surprise is great, when you recall the numerous murders which have been hid by earth burial, a recent instance of which is to be found in the Chapman (Poluski) case.

"The law even permits burial previous to registration of death."

These astounding words are not mine, they are an extract from a Blue Book report, summarising the evidence obtained by a Government Department, appointed to bring up Regulations under the Cremation Act, 1902. It is in evidence that it is not even a legal necessity at a burial to produce so much as a burial certificate; in fact, no documents are necessary for the burial of a body. When one is produced it is directed to be given to the officiating person performing the burial service: this officiating person need not be a clergyman. Whoever he may be, he may crumple it up in his pocket, or put it in the fire, as he pleases, for he has no directions to file or enter it in any permanent record. Certainly no document need be given to the superintendent of the cemetery, unless a local bye-law requests it. You would think this defect needed legal correction, but no, it is left unamended, but on the unoffending heads of Cremationists has fallen stricter and oppressive officious legal regulations, regulations wasting money and time. If the regulations under the Cremation Act are so necessary to prevent poisoning, and here it must be remembered that not the slightest suspicion up to this has yet rested against a cremated case, surely the least that can be done by the State authority is, that it should level up to an equal standard of severity the legal regulations for burials in earth. It is this amendment of the law which I venture to ask this powerful Congress, by resolution, to urge on the Home Office and the Government.

To show how reasonable this is I will quote further from the Blue Book already mentioned: on page six you will find the following paragraph:—

> "In some cases we found that the bodies of murdered persons were buried"—please note, not cremated—"without any certificate of the cause of death. The law unfortunately permits burial without certification of the cause of death."

The scope of inquiry of the Government Departmental Committee, from which I quote, was, of course, limited to its directions, viz., to inquire into Rules and Regulations for Cremations: but those reading the evidence and the report on the evidence will see that from beginning to end it is, *iter se*, a justification for Cremation and a condemnation of

burials. It proves the legal dangers of earth burial, and the safety of the then existing Cremation Regulations up to the hilt. I had the duty of giving evidence before that Commission. I ventured there to point out that in all the poisoning cases, even that of Chapman (Poluski), then under trial, no murderer had been brought to trial until suspicion was aroused about his last, generally unburied victim; that is to say, none of the early victims had any consideration, nor would they have had any, if it had not been that the last case had come under suspicion. It is only when you find out the immense number that different murderers have put away, without suspicion, that you begin to see the dangers of earth hiding. It is left to the imagination to gauge, if these murderers could put so many into the earth without being detected, how many other victims of other murderers must be undetected, and their murderers unpunished.

Another astonishing fact disclosed by the Blue Book, is that, even the first of these murders would have been discovered, if the attempt had been made to cremate them under the old regulations of Cremation.

This is all fully confirmed by the Blue Book report. It says:—

> "In some such cases (as in Palmer's) the facts of the earlier murders did not come before the jury at all."

Then, after some words concerning exhumations, which it says merely strengthens the evidence, the report goes on as follows:—

> "But against this advantage must be set the by far more important consideration, that an effective method of death certification, by bringing to light some of the earlier crimes, at the time they were committed, would prevent altogether the commission of the later crimes."

Surely this is a pungent reason why the regulations for burial of the dead should be brought up to the level of those demanded for Cremations. Let us see then what is said about the efficacy of the regulations for cremations, as they were before Parliament made them more stringent in 1902.

The report says:—

> "Mr. F. W. Lowndes, the Liverpool Police Surgeon, who was intimately acquainted with circumstances of the case of Higgins and Flannagan, two women who poisoned eleven persons for the sake of insurance money, in his evidence before the Death Certification Committee, expressed strongly the opinion *that the enquiry required by the Cremation Society* 'would have undoubtedly revealed the fact that the deaths (of the earlier victims) were not natural,' and would have saved the lives of their earlier victims; and a

similar remark would apply to the case of Mary Ann Cotton, already alluded to, whose victims numbered no less than twenty."

This should be all sufficient to show this Congress that it was not the rules for Cremation, but those for burial that needed strengthening. Here, in two cases, is an admission that, at least, thirty lives would have been saved from the poisoners, if the burial certificates for the first victims had been as stringent as those required for Cremation; yet, in spite of this, in a topsy-Gilbertian-turvey-Sullivan-way, the State Rulers make more stringent that which was strong enough, and do nothing to amend that which they themselves have shown is a danger and enemy to life. I would ask, therefore, the help of this Congress to put this wrong right, by passing the following or some similar resolution:—

1st. "That this Sanitary Congress regrets that the report of the Departmental Committee, appointed to prepare a draft of the regulations under the Cremation Act, 1902, was not authorised to recommend some legal regulations to govern the burial of the dead. Whilst this Congress welcomes any death certification which ensures security for life, it feels the revelations made in the above report of the insecurity for life shown by the want of regulations for burials, and the security for life afforded under the old regulations for Cremation, makes it manifest that immediate legislation is needed to level up the regulations for burials—under which the crimes detected and undetected have been committed—to no less a stringency than those enforced for Cremation, and recommends the Council to pray the Home Office and the Government to take steps to secure this needed reform."

2nd. "That such resolution be forwarded to the Premier, the Home Secretary, and Sir Walter Foster."

These resolutions were not put to the meeting.

CONGRESS AT BRADFORD.

SECTION III.

PHYSICS, CHEMISTRY, AND BIOLOGY.

THE SCOPE AND LIMITATIONS OF BACTERIOLOGY IN THE LOCAL INVESTIGATION OF INFECTIOUS DISEASES.

By P. J. CAMMIDGE, M.B.Lond., etc.

County Bacteriologist for the W. Riding of Yorkshire.

IT is but forty years since Davaine, stimulated by the work of Pasteur on fermentation, suggested that the bacillus described by Pollander as present in the spleen and other tissue of cattle dead of anthrax was the specific cause of the disease. We are so used to this doctrine of the bacterial origin of communicable disease that it is hard to realise that so short a time has elapsed since its birth; but it is to this observation, made less than half a century ago, that we owe its origin. This short period, however, thanks to the labours of numerous workers in all parts of the world, has sufficed to bring about what is nothing short of a revolution in almost every branch of medicine, and in none more so than preventive medicine. To-day we are not only able to treat many of the ills that flesh is heir to with a success undreamt of by our ancestors but, what is still more important, we are able to prevent their onset and to control their spread in a way that is no less marvellous. It is true that still we have much to learn, especially as regards the life history of even the commonest pathogenic organisms outside the body, and that even now the causative

NOTE.—The Proceedings of the Section commenced with an Address by PROF. C. HUNTER STEWART, D.Sc., M.B., F.R.S.E. (*see page* 161).

agent of certain infectious diseases is not accurately known. But the general principles of infection have been fairly well elucidated, and we are at present in a position to attack the public health problems involved in a much more intelligent and scientific manner than was formerly the case.

In our warfare against disease we must not be content with a knowledge of our foes only in theory, but it is necessary that we should apply in practice all the information in our possession as to their modes of life and the peculiarities of each species. Disinfection and isolation on general principles may do a certain amount of good, but their routine practice unguided by scientific knowledge is rather like firing a blunderbuss into a thicket, in the hope that some of the shots may find a mark in the bodies of the animals hiding therein. The efficacy of a disinfectant can now be so readily tested by bacteriological or chemical means that there is no excuse for the haphazard way in which the result is usually left to chance, or to the thoroughness with which the subsequent cleansing operations are carried out. The period of quarantine or isolation in most infectious disorders is still generally determined by taking the average time which experience has shown to be sufficient, but it is an every-day experience of all who make frequent bacteriological examinations of the throats of convalescents from such a disease as diphtheria to find the specific bacillus present, often in large numbers and in a virulent form, several weeks, or even months, after all local evidence of the disease has passed away. During the year 1902 I examined 736 specimens from patients presumably convalescent and ready for discharge, and in 330 of these diphtheria bacilli were found. The throats of most of these patients were re-examined again later; and they were not allowed to return home until a bacteriological examination proved them to be free of infection. To show how such patients may spread the disease, I may mention a small outbreak in the West Riding that was traced to a patient discharged from a fever hospital six weeks after admission for diphtheria. The boy was perfectly healthy to all appearances, save for a slight discharge from one ear; but this discharge, when examined in the laboratory, was found to contain virulent diphtheria bacilli, and was undoubtedly the source from which a brother and two sisters were infected.

Until quite recent years the stools of typhoid patients were considered to be the only important source of danger to others, and they were consequently religiously guarded and disinfected, while little or no attention was paid to the urine. It is now known, however, that typhoid bacilli occur in the urine in at least 25 per cent. of typhoid fever cases, often in enormous numbers, and that they may persist for months and even years.

Hence it is highly important, not only that the greatest care should be taken of the urine during the course of the disease, but that the patient should not be declared free from infection until an examination of the urine has shown typhoid bacilli to be absent. Slightly over 37 per cent. of the urines from convalescent typhoid cases examined in the West Riding County Council Laboratory during the past two years have contained typhoid bacilli, and in one instance they were found eight months after convalescence. This was in the case of a trooper returned from South Africa, and attention was directed to him while searching for the cause of an attack of typhoid from which his wife was suffering. Another case, where the infection was probably transmitted through the urine, was that of the mother of a nurse, who was infected while her daughter was staying with her for a holiday. The urine of both mother and daughter were found to contain typhoid bacilli, and the blood of each gave a well-marked serum re-action with a typhoid culture.

The persistence of the agglutinating power of the blood in many cases of typhoid fever for a considerable time after recovery, although a source of fallacy that has to be guarded against in employing the test as a means of diagnosis, may often be of great service in determining the source of an outbreak of typhoid, or in deciding the nature of an epidemic of a doubtful nature.

In November, 1900, a limited outbreak of what was thought, in the first case, to be meningitis, and subsequently suspected to be typhoid fever, occurred in the members of a family occupying a house in the main street of a village in the West Riding. The source of the infection was not clear, and a bacteriological investigation was consequently undertaken. In August, 1901, a visit of inspection was made, and it was found that the premises in question consisted of a stone-built house with rubble foundations, situated on, and partly built into, the side of a hill. At the rear, and abutting on to the wall of the house, was a foul privy midden with an earthen floor, and into this midden the eaves water from the roof dropped. The cellar in which, at the commencement of the outbreak, the food of the household was kept was below the level of the floor of the privy midden, and at the time of the visit of inspection the walls and roof were covered with moisture. The history of the house, as obtained from the local authorities, was that eleven years previously a man, who had been nursed by a girl of 13, died there of enteric fever. Four of the next occupants of the house suffered from the same disease, and on their leaving, the succeeding tenant was attacked. The cases under investigation occurred in the family of the next occupier. The first to be

affected was a boy of eight. His illness was originally diagnosed as meningitis, but when, shortly afterwards, three other children sickened a diagnosis of enteric fever was made. A sample of blood from the first case was obtained and examined. It still gave a characteristic reaction with a dilution of 1 in 50, although nine months had elapsed between the illness and the examination of the blood. Cultivations made from the walls of the cellar showed large numbers of B. Coli communis, B. Enteritidis sporogenes, and other sewage organisms. There had been no cases of enteric fever in the village for many years, save those recorded above and one in a house opposite in 1895. The water and milk supplies were shared with a large number of other houses in the neighbourhood, in which no cases of enteric fever had occurred. It appears, therefore, that the infection must have been due to some condition peculiar to the house or its inhabitants, and there seems to be little doubt that to the foul and infected privy midden must be attributed the attacks of enteric fever from which the family of each successive tenant of the house suffered, and that the original infection of the midden dates back for at least eleven years.

In a farm, some two miles away from the village before mentioned, there occurred early in December, 1900, a case of what was believed to be mild typhoid fever. Neither the temperature nor the cause of the disease were however typical, and the blood of this patient when examined by the serum reaction the following August, gave an absolute negative result, even with low dilutions. The fact that a quantity of earth excavated from a plot of ground immediately adjoining the house in the village had been spread on a field close to this farm-house made the case of some interest, and although it is possible that the agglutinative action of the blood may have disappeared through lapse of time, it is most probable that the case was really one of influenza.

In a paper read before the Liverpool Medical Institution in 1901, on "The Personal Factor in Tuberculosis," Sir Dyce Duckworth reminded his hearers that at least two pathogenic factors must be regarded in any case of tuberculosis: (*a*) the host, (*b*) the infecting parasite; and he also pointed out that the younger generation of pathologists are apt to "reckon without their host." What is true of tuberculosis is equally true of all infectious diseases, and not only is the presence of the micro-organism necessary, but the host must also be "susceptible." If the host is not susceptible or only slightly so, what becomes of the micro-organisms? They may be destroyed by the natural protective forces of the body, or, if numerous and in a vigorous condition, they may continue to exist without

giving rise to any marked signs or symptoms of disease. It is just these unrecognised mild cases, often only capable of being diagnosed by bacteriological methods, that are liable, when brought in contact with a susceptible individual to give rise to severe, and may be fatal, attacks of disease. A few months ago I had an instructive example of this. A child of four was suddenly attacked with severe dyspnœa. An examination of the throat showed a typical diphtheritic membrane which, on bacteriological examination, was found to be crowded with diphtheria bacilli. As this was the first case in the town for some time, a careful search for a possible source of infection was made. Enquiry showed that an elder sister with whom the patient slept had had a slight sore throat on returning from a holiday in the country the previous week. The holiday had been spent with a brother who was working in a town which was free from epidemic diphtheria, but it was found that he had complained of a sore throat when he first joined his sister. In both their throats virulent diphtheria bacilli were found. It was then ascertained that his fellow lodger had been employed for several days in the week preceding the holidays in a district where diphtheria was very prevalent, and that as a matter of fact he had stayed in a house where cases of diphtheria had occurred. In this instance it would appear that there were at least three intermediate hosts between the two typical cases, and that in one there had been no symptom at all, while in the other two they were so slight that no attention was paid to them. A recent case of diphtheria, occurring in one of the boarders in a large girls' school, also bears on the same subject, and shows how bacteriology may be of service in detecting the source of the infection and preventing its spread. On this occasion, as soon as the case had been proved to be diphtheria, cultivations from the throats from all the inmates of the house were made, and they showed that the cook was probably the source of the mischief, for, although she presented no signs of disease beyond slight reddening of the fauces, her throat was found to be swarming with typical diphtheria bacilli. On being questioned, she confessed that a few days previously she had been to see her brother who was laid up with "a very bad sore throat." Prompt measures to isolate the sufferers and to disinfect the throats of the other girls were successful in limiting the outbreak to those originally affected; but had it not been for the assistance rendered by the bacteriology in detecting the source of the infection a widespread and serious epidemic might have resulted.

Other diseases, due to microbic infection, such as anthrax, cholera, plague and tuberculosis, present opportunities for investigation by bacterio-

logical methods, and I think that a wider recognition of this fact by those responsible for the preservation of the public health, would result in a great benefit to the community at large. The objects of all sanitary progress are, first, to make the conditions of life such that disease is prevented, and secondly, in those cases where communicable disorders have obtained a hold, to limit their spread. In carrying out both of these objects bacteriology may prove a useful ally, but it is more particularly in connection with the second that in everyday practice it may prove of use. As further instance of subjects in which such investigations may be carried out with profit, I may mention the bacteriological examination of milk, particularly in connection with infantile diarrhœa, the examination of water, ice cream, shell fish and other food stuffs; researches into the bacterial flora of soil, air, or clothing, etc., etc. But it would be useless to prolong the list, for it is only necessary to instance the work of Prof. Delépine, on the outbreak of food poisoning at Derby, and the recent cases of typhoid fever, shown to be due to infected army blankets, to show how the medical officer and the bacteriologist, working hand in hand, may succeed in making out a case and enforcing reform.

As in every other branch of our profession, there are limits beyond which bacteriology cannot go, and it requires some experience, and an intimate knowledge of the subject, to know what lines of investigation are likely to be of service, and in what directions research is useless. Further, as our knowledge of the subject has increased, many problems, which at first seemed easy of solution, have turned out to be full of pit falls. Bacteriology does not simply mean looking down a miscroscope and seeing a germ with its name written in large characters all over it; in most cases it is only by a series of careful observations under various conditions of food supply, temperature, etc., that it is possible to give a name to a particular micro-organism. A provisional opinion can, in some cases, be given rapidly by a simple microscopical examination, but in most a considerable time must elapse before a reliable diagnosis can be made. The time is well spent, however, for the isolation of a specific disease-producing organism from a case, or a specimen, is sufficient to at once decide the nature of the infection or contamination and indicate the means to be taken to prevent harm arising from it. In some instances, where it is not possible to isolate the specific micro-organism, bacteriological evidence of pollution with fæcal or other organic matter can be detected. For example, it is usually of no avail to search for the typhoid bacillus in a sample of water taken from a supply which is supposed to have caused an epidemic of the disease, for the investigation cannot usually be com-

menced until two or three weeks after the commencement of the outbreak, and by that time, unless the specific infection continue, all typhoid bacilli will have disappeared from the water. Evidence of sewage contamination, and hence presumptive evidence of past typhoid infection, may, however, be often found in such a water in the presence of the more hardy B. coli or B. enteritides sporogenes in large numbers.

In thus briefly, and I fear very inadequately, indicating the scope and limitations of bacteriology in the local investigation of infectious diseases, I have, as far as possible, drawn upon our experience in the West Riding County Council Laboratory, and have, consequently, dealt at greatest length with diphtheria and typhoid fever, but I think that it will be obvious that this is but a very small part of the subject. With a more extended experience on the part of bacteriologists and a wider knowledge amongst administrative officers of the usefulness of such investigations in practice, I am certain that the scope of bacteriology in public health work will be largely increased and its limitations correspondingly diminished. It is essential, however, I believe, if progress is to be maintained and full advantage taken of future developments, that the work should be in the hands of those who, in addition to an expert knowledge of bacteriology, have had a general medical training.

Prof. Trevelyan (Leeds) said he had had a good deal of experience of public health bacteriology during the last ten years in Leeds, and he certainly concurred in what Dr. Cammidge had said in regard to the practical application of bacteriology to public health purposes. There was one great disadvantage in this work, and that was the amount of routine work which it entailed. Routine work spoiled a man, who thus got very little time for research work. It seemed to him that in these public health laboratories it was essential to have a sufficient staff, so that the director of the laboratory would have plenty of time to carry out research work, and keep himself abreast with all the advances made in bacteriology. He need not say that he should hold strongly to the view that those engaged in this work should have had a medical training. It seemed to him that the work could not be done in the same satisfactory way without at any rate a general knowledge of disease.

THE FAILURE OF STEAM DISINFECTION THROUGH RESIDUAL AIR.

By WOLF DEFRIES, B.A.

THE fact that steam used for disinfection must be completely freed from air has now been established for upwards of fifteen years; but circumstances which have come to my knowledge within the last year or two make it appear as though this condition has so long been a matter of pious belief that it is in some danger of being overlooked in practice. The purpose of this paper is briefly to recall to notice the facts that are established in this connection and to offer at least one practical suggestion based upon them.

It will be remembered that in the extremely wide research instituted at the Berlin Gesundheitsamt in 1880 on every method of disinfection that was then known Koch, Gaffky, and Loeffler, and to some extent also Wolffhügel, arrived at the conclusion that saturated steam without pressure possessed a higher disinfectant value than saturated steam under pressure. It was found, for example, in the experiments recorded in the paper of Koch, Gaffky, and Loeffler (Mittheilungen a.d.K. Gesundheitsamte, Bd. I., 1881) that a litre flask of water surrounded in a Papin's digester by steam of which the registered temperature was 120°C. reached only 85° in 30 minutes, a result which appeared to put this class of disinfection entirely out of court. Through the great reputation of Dr. Koch this opinion was widely disseminated for several years. At the same time it was matter of common knowledge that in the laboratories of no less careful and eminent observers (such, for instance, as Nägeli and Pasteur) the process of sterilising by steam under pressure continued to be used to better advantage than that of sterilisation by steam without pressure, and in 1887 Heydenreich (Zeitschr. f. Wissensch. Mikrosk., Bd. 4, H.) published a research finally explaining Koch's paradoxical result. It appeared that Koch's results could only be obtained when air was present in the steam. With pure steam, for example, a litre flask exposed under

precisely parallel conditions to those employed by Koch picked up the full steam temperature in five minutes instead of remaining 35° below it at the end of half an hour, and it was only after a certain amount of air was allowed to mix with it that the results of Koch could be obtained.

It is unfortunate that even in this country and in quite recent years Koch's paper has continued to be quoted in commercial prospectuses and otherwise as being a statement of fact, instead of as the record of a remarkable mistake. Heydenreich's explanation was of course checked in many quarters, and was in every instance confirmed. Gruber, for instance (Centralbl. für Bakt., Bd. III., 1888), investigated in particular the suggestion that the inhibitory effect of the air might possibly be overcome by giving a high velocity to the steam current. He used a current of steam contaminated with air passing at such a rate that the volume of the steam passing through the chamber during the experiment was no less than 100 times the volume of the chamber, and at the end of four hours he failed to obtain a temperature of 100° C. inside a horsehair mattress 6 inches thick. Teuscher (Zeitschr. f. Hyg., 1891, III.) found similarly that for complete disinfection the complete evacuation of air is necessary; and it would be needlessly encumbering this paper to quote the numerous experimental researches which have in every case confirmed this result.

Of late years attention has been called to the point in this country by the elegant experiments of Prof. Delépine (*Journal of State Medicine*, 1897 and 1900), all tending to the same result; and in these papers Prof. Delépine suggested the desirability of controlling the practical operation of steam disinfectors in respect to the freedom of the steam from air. He described arrangements which permitted at any time samples to be taken of the disinfectant atmosphere, and the proportion of residual air to be immediately estimated with approximate accuracy. He also described one instrument in which, by the rate of vibration of an index, it was possible for an observer to detect the moment when complete expulsion of air was attained. At the request of Dr. Charles Porter of Johannesburg, to whose solicitation Prof. Delépine's instrument likewise owed its origin, I endeavoured during last autumn to construct an instrument which would give an efficient control in the hands of an entirely unskilled attendant. For this purpose I found it necessary to abandon the attempt to estimate the quantity of residual air present at any time; and I regretted this the less because it appeared to me a point of academic importance, if complete evacuation could ultimately be secured and indicated. The property of steam on which it was obvious that any such apparatus would have to turn was the circumstance that it could be readily condensed by cold

water, while air would remain gaseous. My purpose was, if possible, to lock some essential part of the mechanism of the disinfector so that the steam could not be confined until it had driven all the air out of the disinfector, or if that proved impracticable, that the attendant could at any time be aware whether the air had been completely ejected. I found it possible to obtain both results, by the construction of which one form is shown in the diagram.

In principle it operates by leading a sample of the disinfectant atmosphere through a cock into a siphon, of which the legs dip into water. The cock is then closed and the water, which is automatically renewed each time steam is admitted, immediately condenses the steam and rises in the legs of the siphon until stopped by any residual air. The legs of the siphon dip into separate vessels, and the difference of legs of the siphon being small, the steam when condensed allows water to rise in each leg in independent columns without starting the siphon, so long as any bubble of air remains at the top. When, however, the last trace of air is eliminated, the two water columns join, and the siphon action being thus established the contents of the upper vessel are immediately and rapidly siphoned over into the lower. By balancing either vessel, or a float contained therein, when the vessel is full or empty as the case may be, and allowing it freedom to rise and fall vertically, a very considerable rise or fall of a weighty moving part (either vessel with its contained water or float with the pressure of its sustaining head, as the case may be) is obtained, and does not occur until the time has arrived for making a definite intimation to some other part of the apparatus that the steam is free from air. In the first instance I attempted simply to provide the attendant with a means of knowing whether he had done his duty or not, and the medical officer with a means of controlling it independently of the attendant. This result was obtained, as shown in the diagram, by connecting the moving part, which in that case was a float (F), with a cock controlling the admission of steam from the disinfector to a pressure-recording gauge. The construction permitted the use of any desired length of lever for turning this cock, and the fall of the float was therefore translated into a substantial and almost instantaneous twist on the plug of the cock, which left no doubt as to the certainty of its action. When during the process of disinfection it was necessary to do anything which might possibly re-admit air into the apparatus for which this valve was designed (this means when the steam-exhaust valve was opened), the lever of the steam-exhaust valve, operating through a link, closed the cock of communication between the disinfector and the recording gauge and

re-charged the air-controller, so that, before further disinfection could be recorded on the gauge, it was necessary for the operator to try on the air-controller whether any air was present in the disinfector. In practice I may say that the amount of air re-admitted on evacuation of steam proved to be little or none, and no appreciable delay was caused to the operation by the necessity of working the air-controller a second time. With this apparatus, therefore, the recording gauge traces the pressure to which the objects to be disinfected have been exposed only during those periods when no air was present in the disinfector, and the responsible officer by glancing over his chart had presented to him no pressures which were due to any medium except pure steam.

Since constructing this appliance I have come to the conclusion that it may be desirable to go a step further, and make it impossible for the operator to close the valve through which initially the air escapes until the steam is entirely free from air. This object is attained by causing the motion of the valve through which steam is admitted to open automatically the valve by which the air escapes. This air-valve remains open until the air controller has siphoned over; the motion of the moving part in that case being used to close the air-valve at the same time as it opens the recording gauge cock. The air-valve remains closed until after the steam-inlet has been closed to permit steam to be blown off, when it is again opened to resume the disinfection, its motion as at the beginning opens the air-exhaust valve again.

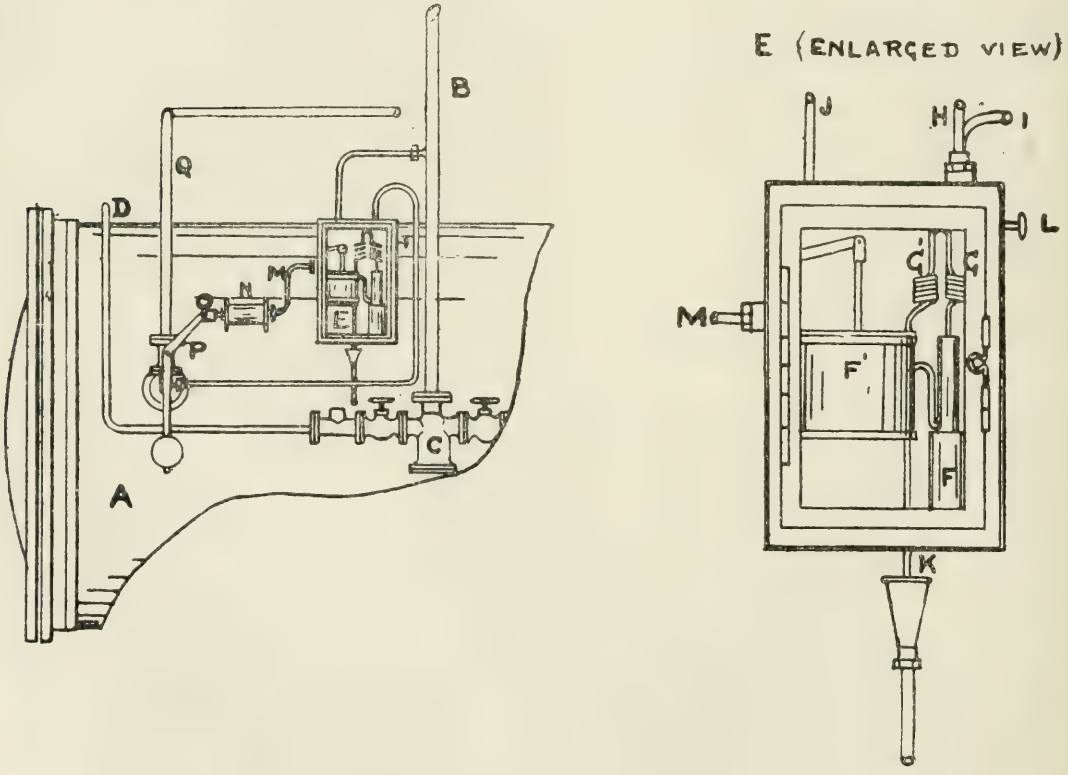
It may be thought by some that the application of an instrument of this character to the routine work of the operator of a steam disinfector is pedantic rather than practical. I quite agree that, if such application were made in the form of an instrument which would give trouble in unskilled hands, no theoretical advantage could justify its use. But supposing that the instrument, as appears to me to be the case in the present instance, does not add to the complication of the plant, and does not increase its liability to go wrong, I think that any such criticism would be ill-founded. It must be borne in mind that in the interior of a steam disinfector objects of varying sizes and quantities are arranged in manners that are naturally varied to suit the convenience of the operator and his load. These objects are filled to a larger or less extent with air when they are introduced into the disinfector, they may possess to a varying extent protective coatings of grease and other substances tending to reduce the disinfectant action of the steam, they are, in a word, subject to that chapter of accidents which are or should be scrupulously excluded in a laboratory, but never absent in practical work. The circumstance that

at temperatures very little above the maximum which is used in steam disinfection, the objects most liable to be subjected to it will inevitably be injured, makes it impossible for us to obtain any margin of safety by simply increasing the temperature. If disinfection is to be considered as a practical art, and not to be applied merely as a placebo, it must conform to the invariable and indispensable conditions of practice, the first of which is that a margin of safety must be allowed well above the theoretical limit. In disinfection, as I have ventured to point out before, it is impossible to obtain any very large margin, certainly no margin that would be accepted by any other art, even those which are far more sure of their data than is the art of disinfection. It is not irrelevant in this connection to remember that in a series of experiments, the nature and results of which appear to have controlled themselves satisfactorily, Christen (Mitth. aus klin. und med. Instituten der Schweiz, III, 2) investigated the resistance possessed by various bacteria to saturated steam of various temperatures, and while he found that when he got up to 140°C. his spores perished within a minute, the same organisms subjected for sixteen hours to current steam without pressure, of which the temperature was controlled at 100°C, survived. If one circumstance seems to have been established more than another in the last ten years, it is the family relationship between groups of organisms and the difficulty of drawing the sharp line of demarcation between them. It may well be believed, as seems to be probable on the balance of evidence, that Christen's results correspond with an unusually high resistance. As against this, however, it must be remembered that he was dealing with naked unprotected organisms under laboratory conditions from which the chapter of accidents was entirely excluded; and as a practical question I cannot doubt that the standard of disinfection should be such as to be capable of coping with this resistance, as indeed was substantially stated by Sir George Buchanan as far back as 1884.

I venture in conclusion to record my thanks to Prof. Delépine, who preceded me by some years in designing and constructing an apparatus for recording the presence of air in steam, for the cordial readiness with which he recognised the independence of the instrument which I have described.

Description of Diagram.—The button L is pushed forward and opens the steam-sampling cock, steam passes through the legs G G' of the siphon, which dip into water-vessels F' F; another cock, H, is simultaneously opened and renews the water in these vessels, so as to prevent it from becoming hot. After the steam has filled the siphon, the button L is pulled back and cuts off steam; water rises in the legs G G'. If uncondensed air remains, it rises to the top of

the siphon, and the float in F' does not fall. Further trials are made with the button L, when it is thought that the air has been completely expelled from the disinfector; when this stage is reached the columns of water in G and G' join and make G G' into a siphon, which empties F' into F, the rate of flow being quickened as soon as it is started by a siphon overflow from F (not shown on drawing). The float in F' falls and opens a cock on the pipe J, through which steam is admitted from the disinfector to the recording-gauge which registers the disinfections; it may also open at the same time a cock on the pipe M, admitting live steam from the boiler to the piston N, which closes the air-exhaust valve P; if P is large the cock on M may have two ports, so arranged that the steam, when not closing P, is holding it open, instead of trusting to the weight to hold it open. The mechanism is so linked with the air-exhaust valve on the disinfector as to throw the air-controlling arrangement into operation whenever communication is opened between the disinfector and the atmosphere. It will be observed that the sole manipulation consists in pulling and pushing the button L.



Mr. Wolf Defries (London) said that the attention of a medical officer would not readily be attracted to the fact that the presence of air in the steam had caused failure of disinfection. It was hard enough to trace the precise cause of most return cases: and most unlikely that a man could be in a position to attribute a return case, after it had been recognised, to the presence of air in steam that had been blown off days or weeks earlier. It was least likely, indeed practically impossible, when the risk of failure through this cause was scarcely ever present in the medical officer's mind when he was considering the design of the machine or superintending its operation.

Mr. F. S. Stell asked whether any specific cases could be given where it had been proved that the disinfection had not been satisfactorily done because a little air had been admitted?

Mr. Defries said that he did not know any return cases traced to this, and had not looked for them because, for the reasons he had given, they would be difficult to trace, and because the evidence leaves no possible doubt that they must inevitably occur. It had been shown experimentally that under laboratory conditions, with everything except the presence of air favourable to the disinfection, they do occur. The demonstration had been repeated again and again with the same result. In practice conditions were not nearly as favourable as in a laboratory, and it would be waste of time to argue in support of so obvious a proposition as that the attendant at the disinfecting station would at least not get better results than the scientific observer in a laboratory. In all other arts the exact contrary was found, and a margin was left over the theoretical minimum to make up for the inevitable disadvantages which occur in practice. To leave a portion of the air in a disinfection chamber was not merely to leave no margin, but actually to expect better results in practice than could be obtained in a laboratory.

STANDARDISATION OF DISINFECTANTS.

By SAMUEL RIDEAL, D.Sc., F.I.C.;
And J. T. AINSLIE WALKER, F.C.S.

THE steadily increasing demand for disinfectants, due in great measure to the fact that the general public are acquiring a better knowledge of the true cause of zymotic disease, has so stimulated invention that many chemical products of undoubted value have been introduced in recent years, but the makers of these genuine articles have to compete with others whose preparations are not only worthless but actually dangerous, since the use of such products gives rise to a false sense of security. There can be no doubt that the public should know that disinfection—that is the killing of disease germs—is by no means a simple operation, and that the control of disease by this means should form part of the routine work in every sanitary area under the direction of the Medical Officer of Health. At the same time it is absolutely necessary that the efficiency of all disinfectants sold as such should have, if not a Government guarantee, at least a maker's warranty which is capable of being checked. As the Medical Officer of Health can only generally control the area under his jurisdiction, the choice of a disinfectant will at times rest with the medical man in charge, the nurse, or the householder, and they require such directions as will ensure freedom from error, and such descriptions of strength as will render the operations as certain as possible. When it is recollected that one case of infectious disease improperly treated is liable to become the source of many others, and that differences of practice in regard to notification obtain in different parts of the kingdom, it will be recognised that this subject is one of more than professional interest.

It is a notorious fact that at present there exists no official control over the sale of disinfectants, with the exceptions of those set forth in the Privy Council Orders of July 27th, 1900, and June 5th, 1902.

The first of these permits the sale, without control, of liquids containing less than 3% of carbolic acid or its homologues, as disinfectants, on the ground that such fluid is not a poison within the meaning of the Pharmacy Act of 1868; and this has the direct effect, obviously, of placing a premium on inefficiency. In the subsequent order it is stated, liquid disinfectants containing scheduled poisons (which for present purposes are practically confined to carbolic acid and its homologues in solutions of more than 3%, and corrosive sublimate) shall be sent out in bottles rendered distinguishable by touch from ordinary medicine bottles, with a label giving notice that the contents of the bottle are not to be taken internally. Formaldehyde, and presumably potassium mercuric iodide, which are both efficient disinfectants, can be advertised and sold as such by anyone without control. Biniodide of mercury has been added to the schedule of poisons in Ireland, but not in England.

It has been frequently suggested that the provisions of the Food and Drugs Act should be extended to such articles. In other countries (*e.g.*, Massachusetts, U.S.A.) such legislation exists, and we hope as an outcome of the present discussion that some Parliamentary action which will effectively deal with this particular problem may be taken in this country.

The absence of a thoroughly reliable test may in a great measure account for this apparent apathy on the part of the authorities. It is obvious that a bacterial, rather than a chemical determination of efficiency is required, as although the strength of a preparation of carbolic acid and its homologues can be ascertained with great accuracy, it is a well-known fact that creolin, for example, does not depend for its remarkable efficiency as a bactericide on the content of these acids. Again, much depends upon the conditions, both chemical and physical, in which the disinfectant is employed. Thus we find that a disinfectant containing 10% of tricresol *in emulsion* is equivalent in bactericidal value to one containing 30% *in solution*, when tested against a virulent culture of B. typhosus.

There is, therefore, a great need for a bacteriological test: but unfortunately, investigations by different bacteriologists have led to glaring discrepancies. These differences are not so much due to the personal equation as to variations in the mode of procedure adopted by the different workers. We feel sure that many of these differences have no real scientific explanation, and that workers would willingly accept any uniformity of procedure which would ensure their results being comparable. We do not think it necessary to draw further attention to the impossibility of reconciling the values given in any two published

reports at the present time, as we feel sure that this is obvious to anyone who has attempted to make the comparison; it is not too strong a statement to make that no two results obtained by different investigators may be compared with any satisfaction, unless all the details of procedure have been agreed upon beforehand. In selecting any particular process to be employed as a standard method for the examination of disinfectants, we submit that the following are some of the factors to be considered, in order that the difficulties we have pointed out may be overcome:—

1st. —Time.
2nd.—Age of Culture.
3rd.—Choice of Medium. Reaction of same.
4th.—Temperature of Incubation.
5th.—Temperature of Medication.
6th.—Variations in vital resistance of same species.
7th.— „ „ different species.
8th.—Proportion of culture to disinfectant.

Viewed as a source of possible confusion this list appears formidable enough, yet most of the difficulty is at once removed by the introduction of a standard control as used by us in the method about to be described.

The standard which we recommend is pure phenol. We are well aware that the so-called pure crystals contain at times as much as 7 or 8 per cent. of water, but if the operation of standardising a solution by means of bromine be considered too tedious the B. P. article will be found to answer the purpose admirably. 110 parts by weight of B. P. carbolic acid contain 100 parts by weight of pure phenol. In many respects this disinfectant has marked advantages over a metallic salt or other standard.

Our method may now be described briefly as follows:—To 5 c.c. of a particular dilution of the disinfectant in sterilised water add 5 drops of a 24 hours blood-heat culture of the organism in broth; shake and take sub-cultures every $2\frac{1}{2}$ minutes up to 15 minutes. Incubate these sub-cultures for at least 48 hours at 37° C. Allowing 30 seconds for each act of medication and the same time for making each sub-culture, four different dilutions of the disinfectant under examination, together with one standard control, may be tested against the same culture, under conditions which make the results strictly comparable. If preferred, the field may be extended and divided into intervals of 5 minutes: but we contend that no table is complete which does not show a positive result in the first column, and a negative result in the last. The strength or efficiency of the disinfectant is expressed in multiples of carbolic acid performing the

same work:—*i.e.*, when we have obtained a dilution of the disinfectant which does the same work as the standard carbolic acid dilution, we divide the former by the latter, and so obtain a ratio which we call the "carbolic acid co-efficient."

The following table shows the degree of refinement to which this test may be carried with a little care:—

TABLE I.—*B. Typhosus* (*Kral*), 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant W	1 : 70	×	×	.	.	.	.	48 hours	37° C.
,, ...	1 : 80	×	×	×	.	.	.	,,	,,
,, ...	1 : 90	×	×	×	×	×	.	,,	,,
,, ...	1 : 100	×	×	×	×	×	×	,,	,,
Carbolic acid	1 : 80	×	×	.	.	.	.	,,	,,

Carbolic Acid Co-efficient $\frac{7}{80} = 0{\cdot}87$.

We are now in a position to discuss the influence of the various factors enumerated.

1st. *Time.*—One of the greatest mistakes made in estimating the relative values of disinfectants is introduced in connection with this factor. We refer to the practice of taking *strength of disinfectant* as the constant and *time* as the variant. A glance at tables II. and IIA. will convey some idea of the extent of the error due to the adoption of this method. It is therefore evident that to obtain regular and consistent results, time must be taken as the constant and strength as the variant.

TABLE II.—*B. Coli*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant No. 1 (containing 19·5 % Cresols)	1 : 200	×	×	.	.	.	.	48 hours	37° C.
Disinfectant No. 2 (containing 10·1 % Cresols)	1 : 100	×	×	.	.	.	.	,,	,,

True relative values = 2 : 1.

TABLE IIA.—*B. Coli, 24 hours Broth Culture at 37° C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		5	10	45	50	55	60	Period of Incubation.	Temperature.
Disinfectant No. 1 (containing 19·9 % Cresols)	1 : 200	×	.	.	.	.	.	48 hours	37° C.
Disinfectant No. 2 (containing 10·1 % Cresols)	1 : 200	×	×	×	×	×	.	„	„

Apparent relative values = 11 : 1.

2nd. *Age of Culture.*—This is a factor which is often ignored. In the usual trial with a non-sporing organism where a primary culture in nutrient broth is prepared and small quantities are mixed with the diluted disinfectant, a variation in the incubation period undergone by the primary culture will make a difference in the valuation of the disinfectant. As an example of this we have prepared a culture of B. typhosus in nutrient broth incubated at 37·5° C. After 16 hours incubation 0·1 c.c. of this culture was removed with a sterile pipette and added to 3 c.c. of diluted disinfectant fluid. The remainder of the primary culture was then incubated for a further 8 hours; 0·1 c.c. was then removed and treated with the disinfectant as before, and this was again repeated after a further incubation of 16 hours. The actual number of typhoid organisms present in the culture was carefully determined at the end of each period. The results were as follows:—

TABLE III.—*B. Typhosus, Broth Culture at 37·5° C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Period of Incubation.	No. of Organisms per c.c. after 48 hours incubtn.	Temp.
		2½	5	7½	10	12½	15	Primary culture.		
									millions	
Disinfectant A	1 : 95	×	×	×	.	.	.	16 hrs.	212	37·5°C.
„	„	×	×	×	.	.	.	24 „	233	„
„	„	×	×	×	×	×	×	48 „	90	„

These results are also of interest in showing that the resistance of a culture to the action of a disinfectant is by no means dependent on the actual *number* of organisms present. In the above instance the typhoid

had reached its maximum degree of multiplication apparently after 16 to 24 hours, and with a further incubation at the optimum temperature the number of organisms diminished; their power of resistance to the action of the disinfectant was, however, decidedly increased. The explanation of this result may be found in the slight clotting of the culture which takes place during protracted incubation. The bacilli in this way appear to be to a great extent protected from the action of the disinfectant by each other, and by their own products. But no false or misleading results can be obtained with an attenuated culture, either by design or through ignorance, where a carbolic acid control is introduced (cf. tables IIIA. and IIIB.).

TABLE IIIA.—*B. Typhosus*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Fluid W [1]	1 : 90	.	.	.	.	.	.	48 hours	37° C.
„ „	1 : 100	×	.	.	.	.	.	„	„
Carbolic acid	1 : 90	.	.	.	.	.	.	„	„
„ „	1 : 100	×	.	.	.	.	.	„	„
„ „	1 : 110	×	×	×	.	.	.	„	„

Carbolic Acid Co-efficient = 1·0.

TABLE IIIB.—*B. Typhosus*, 48 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation,	Temperature
Fluid W [1]	1 : 90	×	.	.	.	.	.	48 hours	37° C.
„ „	1 : 100	×	×	×	.	.	.	„	„
Carbolic Acid	1 : 90	.	.	.	.	.	.	„	„
„ „	1 : 100	×	×	×	.	.	.	„	„
„ „	1 : 110	×	×	×	×	×	×	„	„

Carbolic Acid Co-efficient = 1·0.

3rd. *Choice of medium: Reaction of same.*—For most practical purposes the choice of media is restricted to broth and agar. The behaviour of cultures of B. coli obtained from both is shown in the following tables:

TABLE IV.—*B. Coli*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant A	1 : 1000	×	×	.	.	.	.	48 hours	37° C.
Disinfectant Z	1 : 800	×	×	.	.	.	.	,,	,,
Carbolic acid	1 : 100	×	×	.	.	.	.	,,	,,

Co-efficients { A = 10·0. Z = 8·0.

TABLE IVA.—*B. Coli*, 24 *hours Agar Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant A	1 : 1500	×	×	.	.	.	.	48 hours	37° C.
Disinfectant Z	1 : 1200	×	×	.	.	.	.	,,	,,
Carbolic acid	1 : 120	×	×	.	.	.	.	,,	,,

Co-efficients { A = 12·5. Z = 10·0.

In both cases the higher factor is obtained when using agar cultures, which are prepared by taking up part of the growth on the point of a needle and distributing it evenly in sterilised water; the resulting emulsion may be used in the place of the broth culture, but we recommend the latter as being much more convenient to handle.

The reaction of the medium used for primary cultures is a factor of greater interest.

TABLE IVB.—*B. Typhosus*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Carbolic acid [1]	1 : 90	×	×	.	,	.	.	48 hours	37° C.
Carbolic acid [2]	1 : 120	×	×	.	.	.	.	,,	,,

[1] Culture grown in Broth, acid to phenolphthalein 100 c.c. = 0·6 Normal NaHo.
[2] ,, ,, alkaline ,, 100 c.c. = 0·2 Normal HCl.

N.B.—Both were alkaline to Litmus paper.

These media corresponded therefore to reactions of · —0·2 respectively. The American Public Health Association in ⟨opted a reaction of +1·5 % as the best for general work, and we ha⟩ used this in all tests referred to.

We think that the fresh meat recommended in many of the text books might be replaced by Liebig's extract, to the greater convenience of the operator; but the *reaction* of the resulting broth is a detail which will not admit of any latitude.

4th. *Temperature of incubation.*—The extent to which this factor will affect the power of resistance of a culture to the action of disinfectants is clearly shown in the following tables:—

TABLE V.—*B. Typhosus* (*S.S.*), 48 *hours Broth Culture at* 22° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Fluid W [2]	1 : 90	×	.	.	.	.	.	72 hours	37·5° C.
Carbolic acid	1 : 120	×	.	.	.	.	.	,,	,,

Carbolic Acid Co-efficient = 0·75.

TABLE Va.—*B. Typhosus* (*S.S.*), 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Tempe a-ture
Fluid W [2]	1 : 90	×	×	×	.	.	.	72 hours	37·5° C.
Carbolic acid	1 : 110	×	.	.	.	.	.	,,	,,
,, ,, ...	1 : 133	×	×	×	×	×	×	,,	,,

Carbolic Acid Co-efficient = 0·75 (average of 0·82 and 0·67).

It is interesting to note that in spite of this difference in resistance the carbolic acid co-efficients found for the disinfectant tested are practically identical. The culture grown at 22° C. was allowed twice the incubation period of that grown at blood heat, and should therefore, but for the influence of temperature, have shown the greater power of resistance.

5th. *Temperature of medication.*—No scheme can be considered satisfactory which does not take into account the temperature during medication. Slight variations in temperature of one or two degrees do not

serious [illegible] results obtained by our method, but if the standardising of disinfectants is to become a question of international interest—and we trust it will—then a standard temperature will require to be established. In our own practice we have adopted 15° C. to 18° C. as the range of temperature most easy of attainment throughout the year. The influence of this factor is felt in two different directions: In the first place emulsions prepared from certain disinfectants at 5° C. will be found to yield a very much lower co-efficient than those made from the same disinfectant at 15° C., the explanation in this case being that the ultimate globules of the disinfectant at the higher temperature are in a much finer condition and more evenly distributed. Further it will be seen from tables VI. and VIA. that the bactericidal action of carbolic acid is *at least* 50 per cent. greater at 37° C. than at 16° C. The influence of temperature may be less marked in the case of other disinfectants, but we think that the example given will serve to prove that this is a factor of the first importance.

TABLE VI.—*B. Coli* (*Escherich*), 24 *hours Broth Culture at* 37° *C.*

Room Temperature 16° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Carbolic acid	1 : 70	.	.	.	.	.	.	48 hours	37° C.
,, ,,	1 : 80	×	.	.	.	.	.	,,	,,
,, ,,	1 : 90	×	×	×	.	.	.	,,	,,
,, ,,	1 : 100	×	×	×	×	×	×	,,	,,
,, ,,	1 : 110	×	×	×	×	×	×	,,	,,

TABLE VIA.—*B. Coli* (*Escherich*), 24 *hours Broth Culture at* 37° *C.*

Room Temperature 37° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Carbolic acid	1 : 70	.	.	.	.	.	.	48 hours	37° C.
,, ,,	1 : 80	.	.	.	.	.	.	,,	,,
,, ,,	1 : 90	.	.	.	.	.	.	,,	,,
,, ,,	1 : 100	.	.	.	.	.	.	,,	,,
,, ,,	1 : 110	.	.	.	.	.	.	,,	,,

6th. *Variations in vital resistance of the same species.*—That cultures of the same organism obtained from different sources show marked variations in resistancy is a fact too patent to all investigators to require further

corroboration. We content ourselves therefore by calling attention to tables VII. and VIIa.

TABLE VII.—*Staph. p. aureus*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Carbolic acid [1]	1 : 70	×	×	.	.	.	.	96 hours	37° C.
Carbolic acid [2]	1 : 90	×	×	.	.	.	.	„	„

[1] Culture obtained from Major Firth.
[2] „ „ Dr. Klein.

TABLE VIIa.—*B. Typhosus*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Carbolic acid [1]	1 : 70	×	×	.	.	.	.	48 hours	37° C.
Carbolic acid [2]	1 : 100	×	×	.	.	.	.	„	„

[1] Culture obtained from Major Firth.
[2] „ „ Dr. Rideal.

It will be noted that this is a factor which ceases to be of interest in the presence of a standard control.

7th. *Variations in vital resistance of different species.*—Here again we have a fact which must be well known to all investigators. It may not be so generally known, however, to what extent these variations may work out in practice.

In tables VIII. and VIIIa. will be found the carbolic acid co-efficients of an ordinary coal-tar disinfectant for *Staph. p. aureus* and *B. typhosus.*

TABLE VIII.—*Staph. p. aureus*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant W [3]	1 : 80	×	×	×	.	.	.	48 hours	37° C.
Carbolic acid	1 : 80	×	×	×	.	.	.	„	„

Carbolic Acid Co-efficient = 1·0.

TABLE VIIIA.—*B. Typhosus (Kral)*, 24 *hours Broth Culture at* 37° *C.*

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant W[3]	1 : 250	×	×	.	.	.	.	48 hours	37° C.
Carbolic acid	1 : 80	×	×	.	.	.	.	,,	,,

Carbolic Acid Co-efficient = 3·1.

8th. *Proportion of culture to disinfectant.*—This is perhaps the most important factor of all, and yet it is the one which is most frequently ignored. When the casual reader learns that a certain disinfectant is capable of destroying certain organisms within a specified period of time he accepts the statement as a valuable contribution to our knowledge of the article in question. Yet the absence of this factor entirely robs the statement of any value it might otherwise have. It is in cases such as the following that we find the strongest argument in favour of a standard control.

TABLE IX.—*B. Typhosus (Kral)*, 24 *hours Broth Culture at* 37° *C.*

(*Taking* 5 *c.c. diluted Disinfectant* + 5 *c.c. Broth Culture.*)

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant A²/03.....	* 1 : 450	×	×	.	.	.	.	48 hours	37° C.
,, ,, ...	1 : 485	×	×	×	.	.	.	,,	,,
,, ,, ...	1 : 525	×	×	×	×	×	.	,,	,,
Carbolic acid	1 : 75	×	×	×	.	.	.	,,	,,

Co-efficient $\frac{4.8.5}{7.5}$ = 6·5.

* Allowing for extra diluent introduced with Culture.

TABLE IXA.—*B. Typhosus (Kral)*, 24 *hours Broth Culture at* 37° *C.*

(*Taking* 5 *c.c. diluted Disinfectant* + 5 *drops Broth Culture.*)

Room Temperature 15°–18° C.

Sample.	Dilution.	Time culture exposed to action of disinfectant—minutes.						Sub-Cultures.	
		2½	5	7½	10	12½	15	Period of Incubation.	Temperature.
Disinfectant A²/03.....	1 : 700	.	.	.	.	.	.	48 hours	37° C.
,, ,, ...	1 : 800	×	.	.	.	.	.	,,	,,
,, ,, ...	1 : 900	×	×	×	.	.	.	,,	,,
Carbolic acid	1 : 80	×	×	×	.	.	.	,,	,,

Co-efficient $\frac{9.0.0}{8.0}$ = 11·2.

In conclusion, we venture to think that the facts to which we have drawn attention show the great need that exists for a reliable bacteriological test; and we are further of opinion that the time is now ripe for a general discussion of the whole subject, with a view to obtaining such a consensus of opinion as may result in the establishment of a standard method, which, if brought out under the ægis of The Sanitary Institute, might the more readily meet with official adoption.

Dr. Rideal moved the following resolution, which was passed:—

"That the Council of The Sanitary Institute do appoint a Committee to inquire into the desirability of establishing a standard bacteriological method for determining the efficiency of disinfectants, and take such steps as may be necessary for ensuring the legal control of disinfectants."

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council upon any resolution are published in the page preceding the Law Reports.

Dr. Rideal (London) said he should like to draw the attention of the meeting to some facts concerning the use of carbolic acid. The Regulations of the Army Medical Service for 1897, the last report giving their rules in time of peace, recommended carbolic acid as a useful disinfectant for tuberculous sputa. They stated that it might also be employed as a disinfectant for cholera dejecta, and if available in the crystal form a five per cent. solution should be used; so that the War Office thought a five per cent. solution efficient for the two purposes. But the Regulations did not state the time of contact, nor the volume to be added to any particular tuberculous sputa or to cholera dejecta, so that in these two particulars it was left perfectly vague as to whether it was to be a long contact with a small quantity, or a very large quantity for a short time. Further, the Order said that the crude commercial form of the acid was weaker and needed to be employed in much larger quantity. Now that statement was not true, for the commercial forms, which contained cresols, were really stronger. Then there was another point in regard to chloride of lime. The War Office Regulations said, "dissolve four ounces of chloride of lime in one gallon of water." Turning to the Local Government Board Regulations he found that they adopted a different method entirely, so that the authorities of the War Office were at variance with the Local Government Board. The Local Government Board Regulations, which were issued three years after those of the War Office, said,

"chloride of lime one pound, water ten gallons," which was about one and half ounce per gallon, whereas the War Office recommended four ounces per gallon *for ten minutes.* The Local Government Board did not mention the time of contact. It was interesting to note other differences. For example, the Local Government Board recommended with regard to chloride of lime that the use of non-metallic vessels should be enjoined for liquids of that sort, whereas there was no corresponding Regulation under the War Office. The Navy printed no Official Regulations, but he found that they used a variety of disinfectants. It was very curious that izal happened to be a disinfectant in use in the Navy, and particulars of the use of izal were also given by the War Office, but other proprietary articles were omitted from the list. This was singular, because he was certain that there were many other proprietary articles which could be usefully employed if their strengths could be declared.

A letter from Dr. Klein to Mr. Ainslie Walker was read as follows:—

> I have read your paper with the very greatest interest, and I quite agree with your argument and the recommendations; in fact, I have for years practically worked on principles in many respects similar to those so ably described in your paper. I have made three annotations indicated on the first page of your proof: (1) Avoid using the word "virulent" in respect of "culture of B. typhosus," because it may lead some people to attach a meaning different from what you intend to indicate. I should think you mean "actively growing" culture (Mr. Walker said the word was overlooked in reading the proof. The word they wished to use was "vigorous", not "virulent."). (2) I recommend that subcultures of the medicated microbes be made both in broth and on agar; the latter controls the former in this way: if you make your subcultures in broth only, and growth takes place—shown by turbidity—you cannot be quite sure that this growth is due to your medicated microbe having caused it, but if at the same time you have made an agar surface culture you are at once better able to judge of it, because the growth on agar would in most instances denote the true character of the microbe which you employed. The broth serving for the subculture should be about ten c.c., because in the case of a disinfectant of great potency a big loopful of the disinfectant introduced into, say, only about five c.c. of broth might cause inhibition, or at least retardation of growth taking place. If, however, the subculture be made in broth only, then it is necessary to make a further, second subculture on agar from the medicated growth, in order to be certain that you were dealing with the survival of the employed microbe. (3) I should also recommend that the subcultures be incubated seventy-two hours, in order to make sure that no growth occurs. Your insisting on the subcultures being incubated at 37 C. is very important. Experience has taught me that a medicated microbe might fail to develop at 20°—21° C. when it would develop at 37 C. Your tables are highly instructive.

DR. ROBERTSON (Sheffield) said the subject of the paper was one in which he had been interested for a number of years, and he had worked on lines somewhat similar to those which had been described, though his work had given somewhat different results. One might take it that there were two classes of users of disinfectants. (*a*) Local authorities and Government departments who bought disinfectants in large quantities and gave specific instructions as to their use, and (*b*) the general public who bought disinfectants and used them in a more or less valueless manner, getting practically no good results from their use. He had dealt with the matter from the local authorities' point of view; the question to which he set out to find an answer being, what was the best disinfectant for a local authority buying large quantities for specific purposes and what were the best directions to give for its use? About five years ago his colleague, Dr. Hector, and himself carried out a long series of experiments on the subject extending over a couple of years. They got disinfectants which were commonly used by local authorities over England. They also purchased samples from makers and obtained information from the makers as to their value. But they very soon found that in order to test one disinfectant against another it was impossible to adopt one standard alone. Everybody must admit that there was no one standard by which all the properties of disinfectants could be tested. His remarks applied to one test alone, the poison to kill the typhoid organism in a typhoid motion. Instead of taking carbolic acid they took acid corrosive sublimate solution, of which an accurate solution could easily be obtained by everybody. They worked out the amount of corrosive sublimate required to completely kill the typhoid bacillus in such a motion and then estimated the cost of 1,000 gallons of such a solution, one could get results that were absolutely uniform, and then they tested other disinfectants against the corrosive sublimate standard and worked them out on a cost basis. The cost basis they took was the cost of 1,000 gallons of efficient disinfectant. The disinfectants were to be efficient for the disinfection of their standard typhoid stool in half an hour, and they found that acid corrosive sublimate solution was quite the cheapest disinfectant on the market. It cost, speaking from memory, about 6½d. per 1,000 gallons, that was buying the corrosive sublimate in large quantities from the makers. The prices of disinfectants tested against it went up to £128 per 1000 gallons in the case of one very much advertised disinfectant. That was to say the public were paying £128 for what could be got, just as good and efficient, for 6½d. After the corrosive sublimate solution came the various hypochloride solutions which cost from 1s. 3d. to 2s. per 100 gallons. Then there was a long interval, the next disinfectants in the sale (the tar oils) costing about £2 10s., £2 15s., and £3 per 1000 gallons. He thought the cost basis, so far as any one particular quality of disinfectant was concerned, was the best to go on, but it must be tested, as Mr. Walker said, against a standard, and if one tested a number of disinfectants he thought it would be found that acid corrosive

sublimate standard would give clearer and more accurate results than the carbolic acid one. He had rejected 'absolute' phenol as a standard on account of the difficulty of getting a definite "end point" in the reactions and also because no two samples of 'absolute' phenol gave quite the same results.

Dr. Christopher Childs (London) said he thought they were much indebted to Dr. Rideal and Mr. Walker for working out and bringing that subject before the Congress. There was a great difference of opinion at the present time with regard to the relative value of disinfectants, owing to the different methods of investigating the question, and other causes. He would be prepared to support the resolution placed at the end of the paper.

Mr. Wolf Defries (London) said that the authors had put forward a more practical and definite proposition than he had previously seen for dealing with a very serious difficulty, and he thought that Dr. Rideal had done a considerable service in bringing forward his resolution. The authors had expressed themselves strongly, though not at all more strongly than the facts warranted, as to the chaotic condition of much of the literature of disinfection. It was indeed rare to find two papers of which the results were strictly comparable; much more so than to find individual papers in which the results were rendered useless through some defect in the process of examination, or through the absence of information as to some essential detail. The fullest sympathy was therefore due to the first practical proposal towards remedying this state of things; but it must be clearly recognised that the proposal entailed an enormous amount of labour and critical consideration. The deliberate, systematic, and long continued work which was necessary could not be obtained from the hours of leisure of any man or men; and the first condition of any sort of success was therefore that the investigation should command the services of competent observers who would be paid on a professional basis. The paper having been only just put into the hands of members, it was necessary to take from the experiments of the authors themselves any illustrations to justify this view of the extent of work which remained to be done. In doing so, it was, he hoped, needless to disclaim any desire to pick holes in this admirable paper. The object of pointing out such discrepancies as had struck him in reading the paper was to illustrate how in existing conditions it was difficult, even in the best work, to avoid discrepancies; and had time allowed the reference, it would have been as easy to have taken the illustrations from papers on the subject which had become classical. In the first place, the method of inoculation which seemed to have been used would be liable in some cases to give quite misleading results. The broth culture used for test was introduced into disinfectant of known strength in the proportion of five drops to 5 c.c. Assuming that the broth was thoroughly mixed with the disinfectant, this gave a strength of $\frac{100}{105}$ of the original dilution; and of this

it appeared that 0·1 c.c. was sub-cultured into 5 c.c. of broth, giving a strength of 1 : 52·5 of the original dilution. Quite a considerable number of disinfectants introduced in this proportion into the sub-culture would be strong enough antiseptically to prevent growth, and thus entirely to frustrate the object of the sub-culture, even when they had wholly failed to disinfect. If, for instance, the original dilution had been a 2 per cent. formaldehyde solution, the sub-culture would be a good deal stronger than a 1 : 3000 solution; a strength which is much more than is usually necessary for prolonged or even permanent antisepsis, although organisms might continue alive and grow readily when removed from it into favourable conditions. The case might be still less satisfactory if, instead of a homogeneous solution, the disinfectant was presented as an emulsion. If bacteria were observed under a high power in a drop containing a solid or an oily particle, it would often be found that they more or less loosely attached themselves to such particle; and there seemed to be nothing to exclude the possibility of the organisms transferred into the sub-culture being temporarily fixed in this way to the floating particles, and being thus restrained from growth by an even stronger antiseptic atmosphere than was present in other parts of the sub-culture, or even than the average strength of the original disinfectant dilution. The attachment of bacteria to such particles being certainly not permanent or trustworthy, effects of this kind cannot be reckoned upon in practice, and when they occur in experiment they represent the disinfectant as of a totally different efficiency to that which it really possesses. The authors had, for instance, recorded the extremely interesting result that the same disinfectant appeared to possess in emulsion three times the strength it exhibited in solution; and it certainly seemed at least as likely that this appearance was due to an antiseptic effect exercised in the sub-culture by the transferred particles as that it arose from so wide a divergence of behaviour in the disinfectant itself. The authors again stated that cultures of the same organism of different ages might vary in resistance to disinfection, but that the ratio of their resistance against one disinfectant to their resistance against carbolic acid would remain constant. A good deal of evidence would be required to support so general a proposition; and either a misprint had occurred in tables III. and IIIA. or the "carbolic-acid co-efficient" of the disinfectant W was higher in the 24 hour culture than in the 48 hour culture. A further point of enormous practical importance was the influence of the natural environments of the organism upon the disinfectant, which he gathered had been considered to some extent in Dr. Robertson's experiments; such a reaction, for instance, as had been studied in the case of perchloride solutions. Other illustrations could be found in the paper, both in what was said and what was omitted, to show that the problem of standardising disinfectants was a huge work, not to be undertaken without means adequate to provide for a prolonged enquiry. If The Sanitary Institute could organise such an enquiry it would confer a very great benefit on this country, and indeed be doing a work of international importance. If, on

the other hand, it was unable to secure such an investigation, it would be merely adding to the mass of inconclusive results which already encumbered the literature, and by investing them with an appearance of authority and finality would run the risk of doing more harm than good.

Dr. S. G. Moore (Huddersfield) said the subject was one of great interest to sanitarians. He took it that from the time when they first devoted themselves to the question of disinfection they had had in their minds, more or less constantly and prominently, the need of getting some standard for disinfectants. But he thought it was equally true that they had not hitherto considered the subject from a thoroughly scientific standpoint. Dr. Robertson, some years ago, commenced a line of inquiry which led him to consider the subject, but it had not been brought prominently forward as it had been to-day. But what he wished to say particularly was, that it seemed from the course of the discussion that we relied for our disinfection and for our freedom from certain forms of disease upon chemical disinfectants more or less absolutely. After all, chemical disinfection was nothing better than a makeshift. The idea that by the employment of one or other substance we could do away with the cause of disease was much too prominent in the minds of the uninstructed public. The ordinary householder believed that by scattering more or less of a powder in the vicinity of his or her drains, or by adding a certain volume of fluid to a foul ashpit, that they had been disinfected. That of course was very regrettable, and he thought it was worth while to point out that, as he had said, the use of chemical disinfectants was only a makeshift, and that we ought rather to rely on the prompt removal and prompt destruction of infected material, and all organic refuse, and attempt to dispel the common delusion that by disguising one stink by another we had removed innocuous dangerous accumulations of decomposing material.

Mr. J. H. Worrell (Sheffield) said it was easy to criticise a paper like that, which had been read, on points of detail, yet it was a fact, which none of those interested in disinfection could lose sight of, that there ought to be some standard to which to refer. As one who had been privileged to discover a disinfectant which had been widely used, and speaking from the standpoint of a chemist, it might be thought that he would favour chemical examination, but he considered that Dr. Rideal's method was far preferable to any mere chemical test that could be applied to determine disinfecting power. If one took a series of tests of bodies derived from a known source, then a chemical test would measure very fairly the disinfecting power of the bodies dealt with, but when the disinfectant was taken from many various sources a chemical test could by no means measure satisfactorily the disinfecting power. Therefore he thought that Dr. Rideal's paper was very opportune. Some observations had been made on the variation in the virulence of certain disease-germs. Dr. Andrews, in a very interesting paper read before the Pathological Society of London the previous year, pointed

to the fact that he had obtained a virulent strain of Staphylococcus pyogenes aureus which actually resisted mercuric perchloride 1 in 500 for twenty minutes, whereas carbolic acid, 1 in 40, actually destroyed the same in about two minutes, and another disinfectant, 1 in 400, destroyed it in less than one minute. This was a very striking illustration of the necessity of working with a standard, not only from the standpoint of disinfectant-action, but also from that of alteration of germ-virulence. As to the disinfectant which should be taken as a standard, this was of course a matter open to argument. He might point out, however, that, where there was any chance of albumen being present, mercuric chloride was apt to give very uncertain results indeed, and since it was easy to obtain a definite carbolic acid (as in the B. P., or, better still, by standardising) he thought that, as a commencement, one could scarcely choose a better disinfectant than the latter to which to refer the others.

Dr. Rideal (London), replying on the discussion, said the advantage of mercuric chloride as compared with carbolic acid as a standard was a question of pro and con. As to the Government taking the matter up, he was afraid that if they waited for them they would have to wait a good many years. The Sanitary Institute had done good work in various directions. and he thought it was a direction in which more of such work might be done. If they could get two or three men like Dr. Klein to take an interest in the matter, he thought they would get something that would be useful to them in practical work, and which might ultimately lead to the adoption of a legal standard.

THE SELF-PURIFICATION OF "MADE-SOIL."

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(MEMBER.)

THIS subject is a very important one from a practical point of view. Animal and vegetable matter contained in house refuse has been in the past, and is to a very large extent at the present day, disposed of by depositing it upon land outside the town. It is generally deposited in hollows and inequalities and so serves the subsidiary purpose of levelling up the surface of the ground.

Cartage being costly, such deposition as a rule takes place in the immediate neighbourhood of the town. With the extension of the town this waste ground becomes a valuable building site and a monetary asset.

Too frequently, unless restrictive bye-laws are in force, pecuniary considerations take precedence over sanitary, and such made-soil is built upon long before it can become to any satisfactory degree purified.

The material deposited is obviously polluted. It is readily decomposable, and its decomposition must cause the evolution of offensive gases. Everyone will admit that such made-soil is unfit to build upon when recent, while that such soil will eventually become broken up, decomposed and rendered harmless seems equally incontrovertible.

Apparently, however, very little is known as to *when* such soil will become a possible and sanitary one to build upon. The model bye-laws of the Local Government Board prohibit the erection of a new building "upon any site which shall have been filled up with any material impregnated with any animal or vegetable matter, or upon which any such matter may have been deposited, unless and until such matter shall have been properly removed by excavation or otherwise from such site." It is frequently impossible to remove by excavation such material.

Is land which has been so used to be never built upon?

This is hardly reasonable to expect, and at any rate will not be practised by Urban Authorities.

It is of great practical importance, if possible, to gain some idea of the purification progress likely to be met with under different conditions.

The question seems to be strictly comparable to the problem of the self-purification of streams contaminated by sewage, only one which is vastly more complicated.

The subject is an extremely complex and difficult one, and a full investigation must of necessity take many years before definite results can be arrived at, and the details of the following investigation are brought forward only as a preliminary report dealing with certain aspects of the subject.

It will probably be said that such work is not of much value because of the varying conditions which are met with in different towns and in different patches of made-soil. On the whole, I think these differences are exaggerated. The composition of the material dumped down would not, I should imagine, be very different all over the country. The physical conditions to which it is exposed are frequently very similar.

Such material is usually deposited in the form of mounds upon hollows of clay. For the moiety of such soils, the soil on which the material is deposited (impervious clay) and the degree of air access would probably be quite comparable, while the third important factor, the degree of moisture, is not widely different. In other words, broad conclusions from experiments with one set of such soil are probably applicable to the ordinary made-soil found all over the country.

Except for Parkes and Sanderson's experiments in 1871, and which are always quoted in the text books, I have not come across any work in this direction.

The experiments of these two investigators hardly bear upon the question in its present day aspect, and do not deal at all with the bacteriology of the subject. The following work is based upon an investigation undertaken for the Cardiff Corporation, the primary object being to ascertain the rate of self-purification. The chemical analyses were all made, under my direction, by Mr. J. H. Sugden, B.Sc., F.I.C., Assistant Bacteriologist to the Cardiff and County Public Health Laboratory, and I am indebted to him for the great care he has taken and for many valuable suggestions.

The Medical Officer of Health for Cardiff, Dr. Walford, has been kind enough to have the temperature accurately taken, and has been at great pains to verify the exact dates of deposit of the house refuse.

A large amount of preliminary work was performed to ascertain the best methods of working, sampling, etc. The results of these experiments are not recorded here.

I. *Composition of the material tipped.*—The material tipped consists of the ordinary dustbin refuse and mixed with road scrapings and sweepings. In no case was any sewage or liquid refuse added.

The dustbin refuse consists of cinders, ashes, vegetable, and animal refuse, etc. Its content has remained the same for very many years.

In every case the refuse was tipped upon stiff clay.

For all the soils, up to seven years old, the samples were taken from huge mounds of the material deposited upon the clay. These mounds were in many cases 15 to 20 feet high, and 30 to 60 feet from side to side. In the samples of later date the soil had been levelled up, and formed part of the surface of the ground.

II. *Method of sampling.*—All the samples recorded were collected and examined in exactly the same way. They were all collected by a sterilized Fraenkel's borer from a depth of exactly two feet. Six to eight separate borings, each about one foot apart, were made for each sample. The samples were transmitted to the laboratory in sterile petri dishes.

III. *The examination.*—Both chemical and bacteriological examinations were made. The following gives the processes and determinations adopted:—

A. *Bacteriological examination.*—The sample, as soon as received (or within two hours), was thoroughly broken up and uniformly mixed in the petri dishes by means of sterile spatulas. 10 grms. were then rapidly, but accurately, weighed out on to sterile glazed paper, and added to 100 cc. of sterile water in a large flask. The cotton-wool plug of the flask was replaced by a sterile rubber cork, and the whole thoroughly well mixed. This flask, labelled dilution A., was then allowed to settle for exactly five minutes. Then, without disturbing the contents, 1 cc. of dilution A was added to 9·0 cc. sterile water; labelled dilution B.

Dilution B well mixed, then 1 cc. added to 9·0 cc. sterile water = dilution C.

Dilution C well mixed, then 0·1 cc. added to 9·9 cc. sterile water = dilution D.

Different amounts of dilutions A, B, C, D, were used for the examination.

For a few of the soils a dilution E, containing $\frac{1}{10}$ of dilution D, was made also.

1 cc. dilution A was assumed to contain the organisms in 0·1 grm. of soil.
1 cc. „ B „ „ „ „ 0·01 „
1 cc. „ C „ „ „ „ 0·001 „
1 cc. „ D „ „ „ „ 0·00001 „

It is obvious that such assumptions must be inaccurate, since soil does not mix uniformly with the water; it is merely claimed that comparable results are obtained. The following determinations were made:—

1. Total number of organisms (aërobic).
2. Number of B. Coli.
3. Number of B. Mycoides and of Bismark-brown Cladothrix.
4. The smallest quantity of soil producing indol in one week at 37° C., grown in peptone water solution.

The total number of aërobic organisms was ascertained by making gelatine plates with various quantities of dilutions C and D.

The number of B. Mycoides and Bismark-brown Cladothrix were also ascertained approximately by direct counting from gelatine plates.

To examine for B. Coli., after much preliminary work with the ordinary methods, the following was found the most satisfactory:—

Varying quantities of dilutions A to D were added to Durham's tubes (*i.e.*, one test tube within another for gas formation) containing 1 per cent. peptone, and 1 per cent. lactose. These tubes were incubated at 37° C., and all which showed gas were brushed over ordinary gelatine (in some cases agar also) plates. Only those which showed no gas at the end of a week were not brushed. In many cases the tubes were brushed two or three times if gas was produced and B. Coli could not be found.

The results of these examinations are given in Tables I. and II., and in Charts I. and II.

B. *Chemical examination.*—The soil, after the 10 grms. required for the bacteriological examination had been withdrawn, was air-dried over night. It was then passed through a coarse sieve (10 mesh to the inch), the particles of stone being rejected. The soil was then well mixed and placed in a stoppered bottle, all weighings being made as soon as possible. The following determinations were made:—

1. *Moisture.*—5 grms. of soil were dried at 110° C. until the residue was of constant weight.

2. *Volatile organic matter.*—This was estimated by the further loss, after igniting carefully at a low red heat, recarbonating with ammonium carbonate and again heating to drive off excess of carbonate.

3. *Free ammonia.*—Quantities of soil varying from ¼—1 grm. accord-

ing to the character of the soil, were taken. This was distilled with 250 cc. of ammonia free water (a few pieces of scrap platinum added to avoid bumping) and two portions of 50 cc. each were distilled and nesslerized.

4. *Albuminoid ammonia.*—After determination of the free ammonia, 50 cc. of well-boiled alkaline potassium permanganate were added, and two portions of 50 cc. each were again distilled and nesslerized.

5. *Nitrates and nitrites.*—Tested for in the ordinary way in filtered extracts from weighed quantities of the soil.

6. *The oxygen absorbed in three minutes.*

7. *The increase in readily putrescible organic matter (incubator test).*

The last two results were obtained as follows:—10 grms. of the soil were well shaken in a 250 cc. graduated flask made up to the 250 cc. mark with boiled distilled water. This was then allowed to stand over night Then 100 cc. of the supernatent liquid were pipetted off, and the oxygen absorbed in 3 min. estimated, after the addition of 5 cc. of a 1 in 4 solution of sulphuric acid, by titration with $\frac{N}{80}$ potassium permanganate.

For the incubator test, 10 grms. of soil were placed in a stoppered bottle; this was then almost completely filled with boiled distilled water and kept at 90 F. for seven days, being well shaken at intervals. The mixture was then washed into a 250 cc. flask, made up to the mark with freshly boiled distilled water, shaken and allowed to stand over night. 100 cc. of this was pipetted off and the oxygen absorbed in 3 min. again estimated. Any putrefactive odour in the stoppered bottle after incubation was noted.

The results of these analyses are given in Table III. and Charts III., IV., and V.

IV. *Temperature determinations.*—These were all taken at a depth of 4 feet and were controlled by taking readings at exactly the same time from a soil thermometer at a depth of 4 feet in normal soil.

In the series recorded 18 samples were obtained and examined. They are numbered 1 to 18, and their ages, *i.e.*, date since deposition, are indicated in the different tables. The dates of collection are the following:—Nos. *1*, *2*, and *5*, Feb. 2nd, '03; Nos. *4*, *7*, and *9*, Feb. 9th, '03; Nos. *11*, *13*, and *14*, Feb. 16th; Nos. *3*, *8*, and *12*, March 3rd; Nos. *15* and *16*, March 6th; Nos. *6*, *10*, and *17*, March 9th; and No. *18* March 16th.

No. 7. This sample was collected as a four year sample, and was in fact deposited four years previously. It was subsequently ascertained that although the part 2 feet down was four years old, yet a top dressing down to about $1\frac{1}{2}$ feet of fresh soil had been subsequently deposited two

years later. This soil therefore had a two-year layer for its upper 1½ feet. The results are not included in the charts, but the figures are included in the tables since they possess an interest of their own.

No. 17. This was a control sample taken from the clay by the side of the refuse mounds, and represents the material on which the refuse was deposited.

No. 18. Is also a control sample. A pure peat soil from upland surface land and free from any possible contamination.

V. *Consideration of the results obtained.*—The total number of organisms present in 1 grm. of soil is very high in the quite recently deposited material. This was also shown by the examination of a mixed sample of the *surface* material taken three weeks after deposition. For that sample about 2 lbs. were collected and thoroughly mixed. Over 60 million organisms per gramme were present. B. Coli was present in fairly large numbers, but no B. Mycoides or Cladothrix were found.

The total number of organisms (aërobic) however rapidly diminishes. After two or three years there is apparently an increase in the total number per grm., only declining again in the very old soils.

In the explanation of these results the examination and numerical estimation of B. Coli in the soil is of value.

From Table II. it will be seen that this organism was found in the one month, and one, two, three, and four year old soils, but could not be found in older soils, although a considerable quantity, up to one-tenth of a gramme of soil, was examined. The only exception was in No. 16, and here its presence (in small numbers only) may have been accidental.

As recorded in Table I., B. Mycoides and the Bismark-brown Cladothrix are absent in the earlier examples. They are met with in three-year old samples, and from that date onwards are regularly met with. These organisms are common organisms of ordinary soil, B. Mycoides being perhaps the commonest soil organism. B. Coli on the other hand is fairly abundant in the refuse as tipped. In Table V. the characters of the B. Coli isolated are given ; they are certainly undoubted B. Coli.

Considering the three sets of data together, viz., total number of organisms, number of B. Coli, number of B. Mycoides and Cladothrix, the following deduction seems not unfounded.

The refuse as deposited contains a very large number of organisms, many of which are in the main different from those met with in ordinary soil. These made-soil organisms, as they may be called for convenience of reference, rapidly diminish in number, under the conditions under which they are placed. This diminution goes on for the first two or three years.

After two or three years however, the ordinary soil organisms begin to invade this material, and apparently thrive abundantly in the rich organic material available to them. This causes a marked increase in the total number of organisms present in the soil, and the total number remains large, until in quite old soils a diminution is again met with.

These soils begin to lose their special bacterial content after two or three years, and from that time begin to take on the characters of ordinary soil.

It is of considerable interest to compare these results with those obtained by Houston (Local Government Reports, 1900–01). This investigator watered soil repeatedly with cesspool sewage in one case and with London crude sewage for another series of experiments. On p. 481 of that Report, in his general summary, he concludes, "Judging from Series 1 and 2 of Part I., there was no indication that the addition of sewage to a soil leads to a marked or, indeed, to other than temporary increase of the sewage microbes in general at the expense of the soil bacteria. On the contrary, the more hardy soil bacteria seemed to oust the more delicate sewage microbes in the struggle for existence." And again, "Judging from Series 1, 2, 3, Part I., and Series A, Part II., the addition of sewage to a soil greatly alters its bacterial composition in respect of *B. Coli and allied forms*. But this alteration tends to become less and less apparent as time goes on. Sometimes the relative disappearance of B. Coli is rapid, sometimes much more slow, and periods of a seeming return to vitality are not uncommon." The diminution of sewage-added B. Coli to ordinary soil seems parallel in my experiments with its diminution in tipped refuse, both apparently to be associated with the action of ordinary soil bacteria. Houston's experiments were with surface soil, but mine were with samples two feet deep.

The *indol* determinations were made as an index of the relative abundance of putrefactive bacteria. The indol curve shows a progressive descent (see Table II. and Chart II.), but evidently putrefactive bacteria are present in such made-soil in considerable numbers, even when ten to twelve years old.

Turning to the chemical analyses, the amount of *organic matter* present shows, on the whole, a gradual decline. For the first two years it is over 20 per cent., subsequently declining. Even in quite old samples, *e.g.*, 13–14 years, the percentage of organic matter remains high.

The total organic matter curve is a valuable index of the uniformity of the sampling and the composition of the made-soil. If the material deposited was of uniform composition, and the conditions which favour

purification were identical, it would be reasonable to expect that this curve would show a uniform decline. That it does not do so indicates what must obviously be the case, that these uniform conditions do not prevail.

The figures also show that, except for the first two years, the purification of the organic matter takes place extremely slowly.

The *albuminoid ammonia* figures give results which are very variable. The curve, one would expect, should give the relative proportions of nitrogenous organic matter present in the different samples. This shows scarcely any decline.

The *free ammonia* figures are more striking. This determination may be taken as an index of the actual presence of the products of nitrogenous decomposition.

The curve shows a rapid decline after the second year: the third, fourth, and subsequent years showing comparatively low figures.

Nitrates and *nitrites* were usually absent. The amount of previous rainfall is probably one of the most important of the factors influencing the result, marked rainfall readily washing these salts out of the soil.

The curve of the *oxygen absorbed in three minutes*, before incubation, shows only a gradual, but by no means uniform, decline.

The results of the *increase in the three minutes oxygen absorbed* test show a well-marked increase in the one month and both the one year old samples (see Chart V.), but for older material the increase is but slight, or non-existent. These figures show a rapid decline in the readily putrescible material, and confirm the free ammonia results.

Conclusions.—It is obvious that many more samples of soil must be examined, that specimens taken at different depths must be collected, and that all varying conditions must be recorded and their influence investigated before definite conclusions can be formulated. From the present inquiry, only deductions and suggestions for future work can be drawn.

All the results seem to show that, at the depth of 2 feet, with these mounds of refuse deposited on damp impervious clay, putrefaction and concurrent purification takes place fairly rapidly for the first 2–3 years. The organisms present in the refuse as deposited rapidly decrease at the same time, but after 2–3 years increase, apparently due to the invasion of ordinary soil organisms. After 2–3 years purification at this depth takes place extremely slowly, and samples 9–10 years old give results very little different from 4–5 year old samples.

It is probable that samples, even as old as 17–18 years, still contain organic matter capable of slowly breaking up and decomposing.

The gradual diminution and disappearance of B. Coli in this refuse is

TABLE I.—*Total number of Organisms, B. Mycoides and Cladothrix.*

All per Grm. of Soil.

No.	Age of Soil.	Total Number of Organisms.	B. Mycoides.	Cladothrix.
1	1 Month.	44,000,000	Nil on any of the plates.	Nil on any of the plates.
2	1 Year.	4,600,000	„ „	„ „
3	1 „	2,600,000	„ „	„ „
4	2 „	2,450,000	„ „	About 10,000
5	3 „	1,000,000	About 8,000	„ 15,000
6	3 „	7,300,000	„ 10,000	„ 20,000
7	4* „	16,800,000	„ 700,000	—
8	4 „	13,500,000	„ 120,000	„ 2,000
9	5 „	6,000,000	„ 57,000	„ 2,000
10	6 „	2,200,000	„ 1,000	„ 5,000
11	7 „	4,800,000	„ 167,000	„ 5,000
12	7 „	8,600,000	„ 25,000	„ 15,000
13	9–10 „	7,800,000	„ 100,000	„ 28,000
14	11–12 „	3,800,000	„ 170,000	„ 20,000
15	13–14 „	450,000	„ 10,000	—
16	17–18 „	2,200,200	„ 20,000	„ 2,500
17	Control Clay.	900,000	„ 2,000	„ 35,000
18	„ Peat.	50,000	Nil.	Nil.

* See page 446.

TABLE II.—*B. Coli in Soils, and Indol Results.*

No.	Age of Soil.	Presence or Absence of B. Coli.	Indol in Peptone Water, per Grm. 1 week at 37° C.				
			0·01	0·001	0·0001	0·00001	0·000001
1	1 Month.	Found in 0·00001 Grm.	+	+	+	+	+
2	1 Year.	„ 0·0001 „	+	+	+	+	+
3	1 „	„ 0·01 „				+	+
4	2 „	„ 0·001 „			+	+	−
5	3 „	„ 0·01 „	+	+	+	+	−
6	3 „	Not found in 0·01 Grm. or less			+	+	−
7	4 „	„ „ 0·001 „ „			+	+	+
8	4 „	Found in 0·001 Grm.			+	+	−
9	5 „	Not found in 0·01 Grm. or less	+	+	+	−	−
10	6 „	„ „ 0·1 „ „		+	+	−	−
11	7 „	„ „ 0·01 „ „	+	+	+	−	−
12	7 „	„ „ 0·01 „ „		+	+	−	−
13	9–10 „	„ „ 0·01 „ „	+	+	+	−	
14	11–12 „	„ „ 0·01 „ „	+	+	+	−	
15	13–14 „	„ „ 0·1 „ „		+	−	−	−
16	17–18 „	Found in 0·1 Grm., not in smaller amounts		+	−	−	−
17	Control Clay.	Not found in 0·1 Grm. or less	−	−	−	−	−
18	„ Peat.	„ „ „ „ „	−	+	−	−	−

TABLE III.—*Chemical Analyses.*

No.	Age.	Moisture (per cent.)	Results stated in Parts per 1000 on Dry Soil.								
			Organic Matter.	Free Ammonia.	Albuminoid Ammonia.	Nitrates in 2½ Grms.	Nitrites in 2½ Grms.	Incubator Test, 6 Days.	Incubator Test.		
									Oxygen absorbed before Incubation.	In 3 Minutes after Incubation.	*Increase.*
1	1 Month.	25·02	236·5	0·656	1·026	Nil.	Nil.	Distinctly putrescible.	0·163	0·418	0·255
2	1 Year.	27·16	214·7	0·915	1·181	„	„	Faintly putrescible.	0·188	0·247	0·059
3	1 „	30·41	266·9	1·293	1·876	„	„	Putrefactive.	0·151	0·296	0·145
4	2 „	34·53	227·9	0·813	1·024	„	„	Faintly putrescible.	0·137	0·107	0·03
5	3 „	32·74	158·5	0·045	0·731	0·048	Distinct traces.	„ „	0·021	0·025	0·004
6	3 „	26·25	168·8	0·108	1·134	Nil.	Nil.	„ „	0·057	0·061	0·004
7	4 „	46·44	254·8	0·112	2·782	„	„	Putrescible.	0·224	0·491	0·267
8	4 „	32·37	100·4	0·065	1·161	Traces.	„	Non-putrescible.	0·126	0·155	0·029
9	5 „	28·55	106·4	0·224	1·278	Nil.	„	Putrescible.	0·092	0·098	0·006
10	6 „	36·92	180·0	0·074	1·078	Traces.	„	Non-putrescible.	0·024	0·024	Nil.
11	7 „	27·22	97·9	0·064	1·497	Nil.	„	„	0·088	0·143	0·055
12	7 „	32·25	197·8	0·040	1·185	Appreciable amount.	„	„	0·084	0·096	0·012
13	9–10 „	41·06	147·6	0·181	1·585	Nil.	„	„	0·085	0·083	Nil.
14	11–12 „	27·39	113·5	0·037	1·166	„	„	„	0·083	0·093	0·01
15	13–14 „	28·78	145·1	0·327	0·991	Traces.	„	„	0·082	0·134	0·052
16	17–18 „	33·86	165·1	0·05	1·078	Appreciable.	„	„	0·038	0·032	Nil.
17	Control Clay.	22·35	41·2	0·015	0·324	Traces.	„				
18	„ Peat.	79·0	...	0·333	10·85	Nil.	,	„	16·66	26·81	10·15

TABLE IV.—*Earth Temperature Records. Depth 4 feet.*

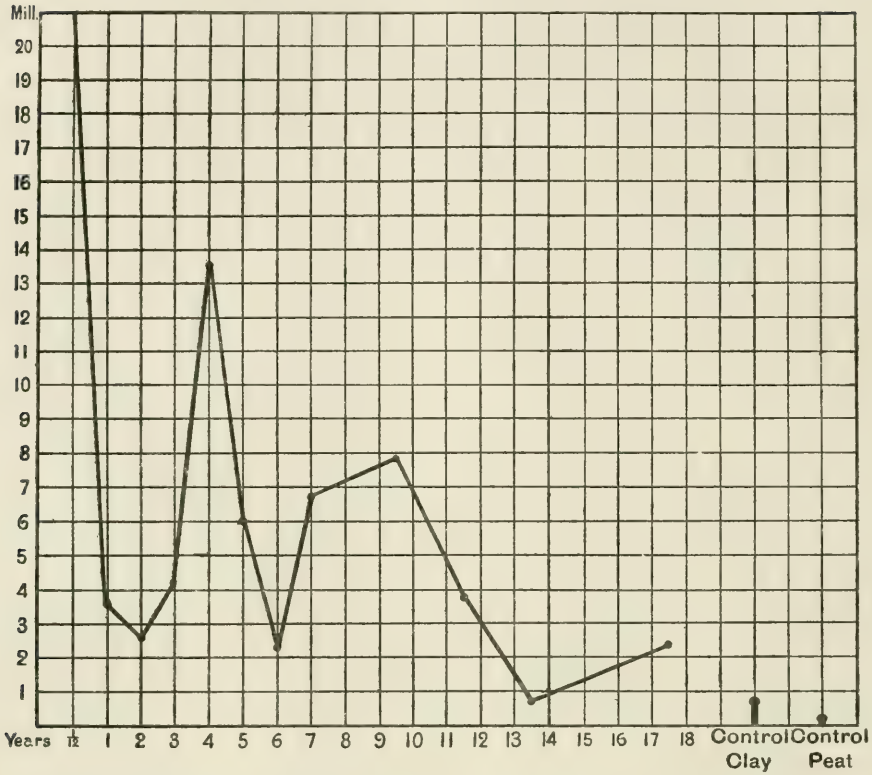
Date of Observation.	Date of Deposit of Refuse.	Temperature in Refuse.	Control Temperature in Normal Soil.
February 9	3 Years old.	60·5 F.	48·0 F.
„ 10	„ „	60·5	48·0
„ 11	„ „	60·5	48·0
„ 12	„ „	60·5	48·0
„ 13	„ „	60·5	48·0
„ 14	„ „	60·5	48·0
„ 16	„ „	60·5	48·0
„ 17	„ „	60·7	48·0
„ 18	„ „	60·7	48·0
„ 19	„ „	60·7	48·0
„ 20	„ „	60·7	48·0
„ 21	„ „	60·7	48·0
March 4	13–14 „ „	48·5	48·0
„ 5	„ „ „	48·0	48·0
„ 6	„ „ „	48·0	48·0
„ 7	„ „ „	48·0	48·0
„ 8	„ „ „	48·0	48·0
„ 9	„ „ „	48·0	48·0
„ 10	„ „ „	48·0	48·0
„ 11	„ „ „	48·0	48·0
„ 12	„ „ „	48·0	48·0
„ 13	„ „ „	48·0	48·0
„ 14	„ „ „	48·0	48·0

Note.—These Observations were repeated at a later date with the same results.

TABLE V.—*Character of B. Coli Isolated.*

Number.	Soil from which Isolated.	Morphology and Motility.	Gelatine Slope.	Broth.	Potato.	Lactose Gas Fermentation.	Glucose Gas Fermentation.	A Neutral Red Reaction (Glucose Agar Shake).	Indol Production.	Litmus Milk.	
										Acid.	Coagulation.
a.	No. 1, from 0·00001 Grm.	Short Bacilli, very active motility.	Bluish Translucent Growth, no liquefaction.	Uniform Turbidity, no scum.	Abundant Pale Yellow Growth.	+ (slow)	+	+	+	+	+ (1 wk.)
b.	No. 1, from 0·0001 Grm.	Short Bacilli, fairly active motility.	,, ,,	,, ,,	–	+ (rapid)	+	+	+ (slight)	+	+ (5 days.)
c.	No. 2, from 0·0001 Grm.	Short Bacilli, very sluggish motility.	,, ,,	,, ,,	—	+ (slow)	+	+	+	+	+ (24 hrs.)
d.	No. 2, from 0·01 Grm.	Short Bacilli, very active motility.	,, ,,	,, ,,	—	+ (slow)	+	+	+	+	+ (1 wk.)
e.	No. 3, from 0·01 Grm.	Short Bacilli, active motility.	,, ,,	,, ,,	—	+ (very slow)	+	+	+	+	+ (5 days.)
f.	No. 4, from 0·001 Grm.	,, ,,	,, ,,	,, ,,	–	+ (rapid)	+	+	+	+	+ (4 days.)
g.	No. 5, from 0·01 Grm.	,, ,,	,, ,,	,, ,,	Pale Yellow Moist Growth.	+ (rapid)	+	+	+	+	+ (2 days.
h.	No. 8, from 0·001 Grm.	,, ,,	,, ,,	,, ,,	– –	+ (fairly rapid)	+	+	+	+	+ (8 days.)
i.	No. 16, from 0·01 Grm.	Short Bacilli, distinctly but not actively motile.	,, ,,	,, ,,	—	+ (rapid)	+	+	+ (slight)	+	+ (3 wks.)

CHART I.—*Total number of Organisms per gram of soil.*



No. 7 Sample is not included in this Table, and when 2 soils of the same age are collected, the average is taken as the number of organisms for that age soil.

CHART II.—*Indol Curve.*

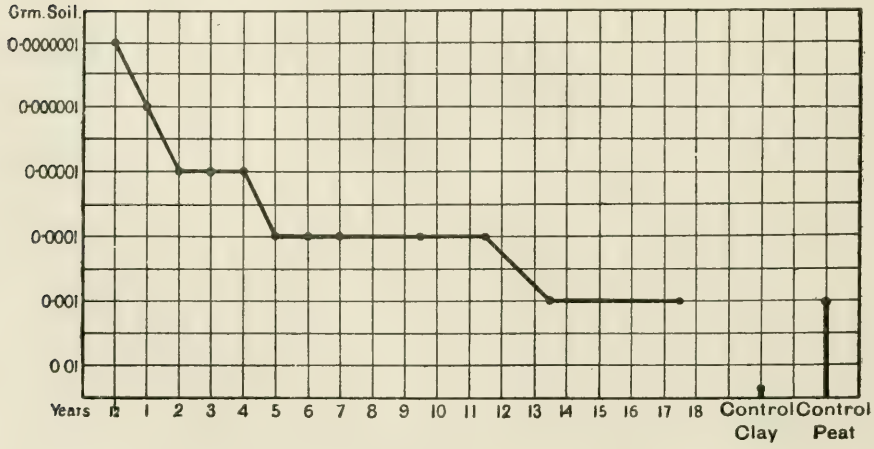
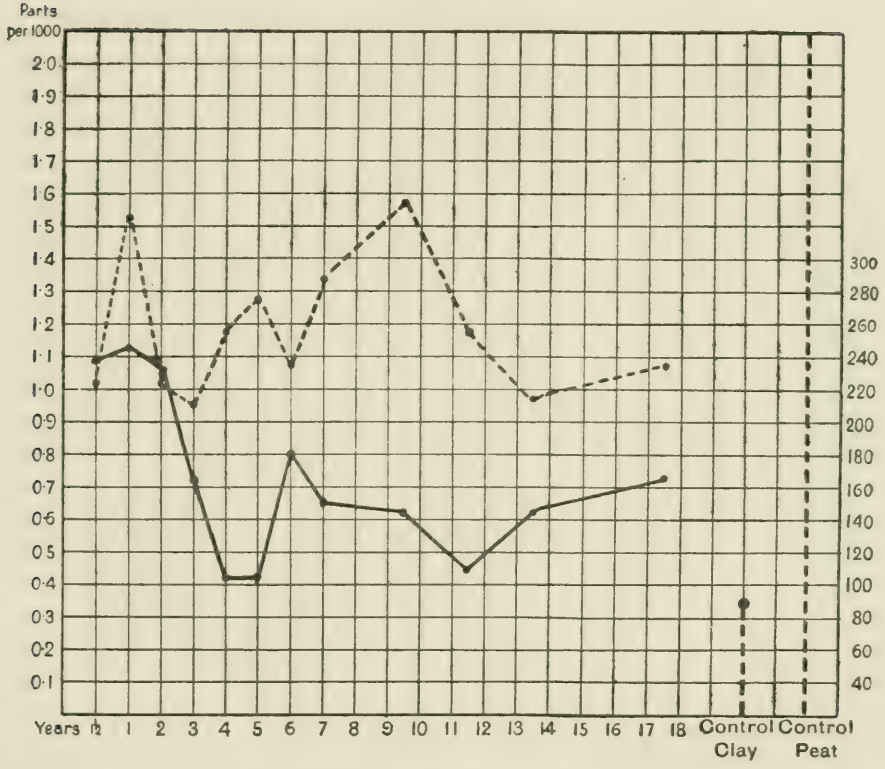


CHART III.

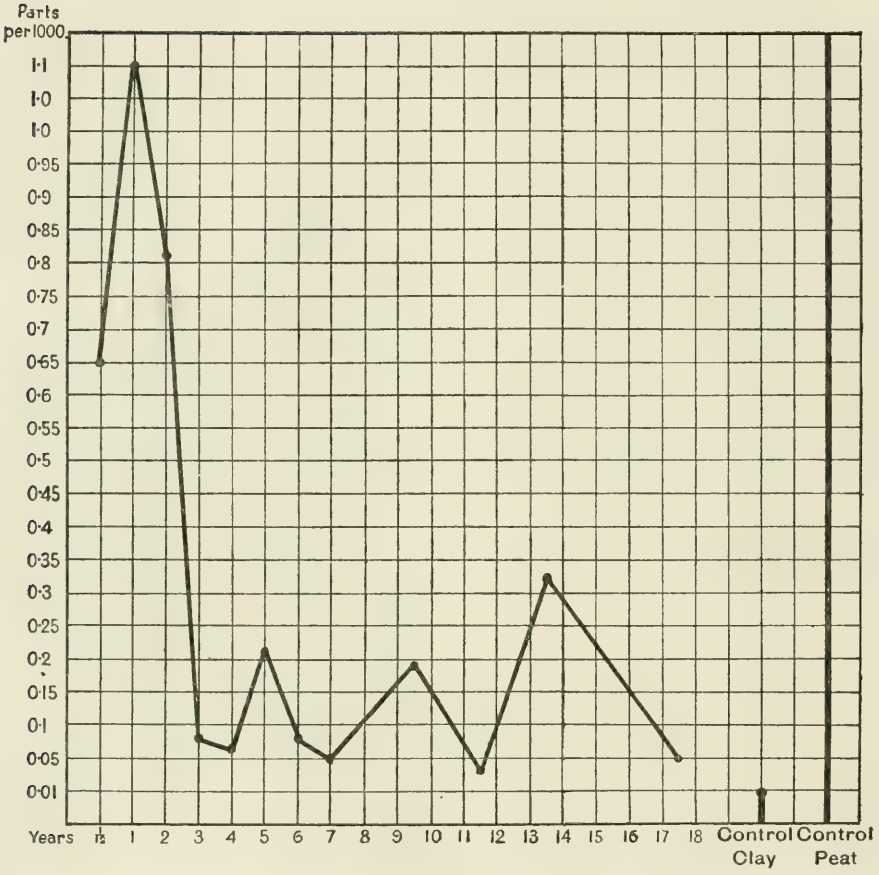
Albuminoid Ammonia—Organic Matter.



Alb., 1 yr.=1·181 & 1·876=1·53 av. Org. matter, 1 yr.=214·7 & 266·9 av.=240·8
„ 3 „ =0·731 & 1·134=0·933 „ „ 3 „ =158·5 & 168·8 „ =163·6
„ 7 „ =1·497 & 1·185=1·34 „ „ 7 „ = 97·9 & 197·8 „ =148

CHART IV.

Free Ammonia.

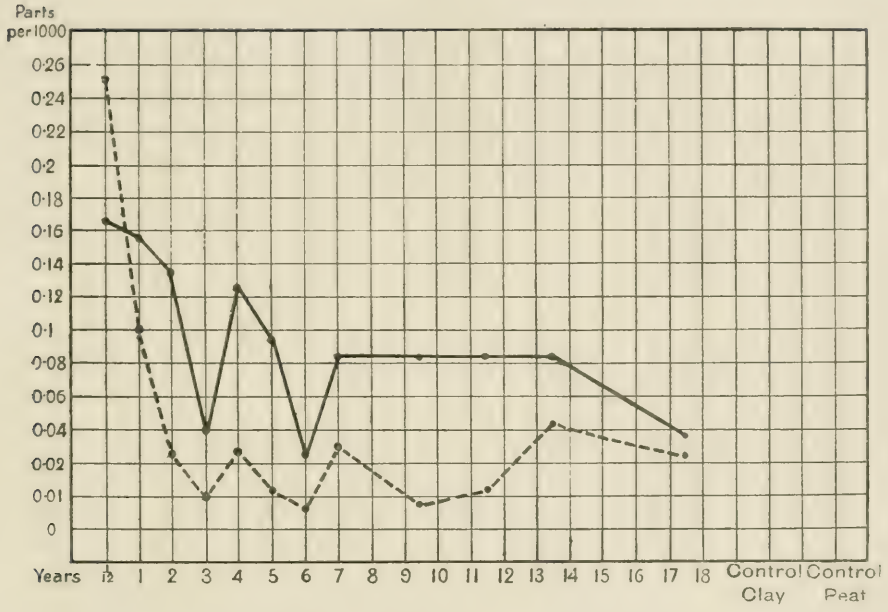


Free Ammonia—1 year = 0·915 and 1·293 av. = 1·104.

„ „ 3 „ = 0·045 and 0·108 av. = 0·077.

„ „ 7 „ = 0·064 and 0·040 av. = 0·052.

CHART V.



3 min. O. absorbed ——

Increase in 3 min. O. absorbed .....

3 min. O. absorbed (before incubation).	*Increase in 3 min. O. absorbed (6d. incubation).*
1 yr.=0·163 & 0·151 av.= ·157.	1 yr.=0·059 & 0·145 av.=0·102.
3 „ =0·021 & 0·057 „ =0·039.	3 „ =0·004 & 0·004 „ =0·004.
7 „ =0·088 & 0·084 „ =0·086.	7 „ =0·055 & 0·012 „ =0·034.

of interest from the point of view of specific contamination. This organism, apparently, readily dies out in such material. It is a more resistant organism than the typhoid bacillus. It is a fair assumption from this that the typhoid bacillus, if present in such soils, would also rapidly die out, and that the danger of *specific* typhoid contamination from building on such made-soil can be neglected.

The temperature results are too incomplete for detailed consideration. They show that decomposition is very active for some years, and as far as they go are very striking. The three year old deposit shows a considerably higher temperature, the difference being as much as 12·5 F. I am hopeful that with further observations it may be possible to establish that the 4-ft. thermometer is a valuable aid to the determination of the rate of purification.

Major R. H. Firth (London) said he was not prepared to accept indol as a satisfactory index of decomposition.

Dr. Rideal (London) said he was personally interested at the present time in the behaviour of pathogenetic organisms in soil, inasmuch as the Royal Commission on Sewage had considered the problem, and many of them would have to look at it from that point of view. Dr. Savage regarded it from a different point. The question raised by Major Firth was, he thought, a little unfair to the author, who had not in fact taken the indol reaction as indicative of the presence of coli. What he did say was that the indol gradually failed in a particular soil, and that therefore this was concomitant with the disappearance of the coli, and that it confirmed the presence of coli at Table V., which seemed to give all the tests necessary to satisfy even one so exacting as Major Firth as to the presence of coli in point of time. Whether this made soil was suitable for building upon even after the coli had disappeared was, he thought, a matter which concerned engineers and architects.

Dr. H. Kenwood (Stoke Newington) thought it was very instructive to note that the author found that "after two or three years the organisms increase, apparently due to the invasion of ordinary soil organisms. That after two or three years purification at this depth takes place extremely slowly, and samples nine or ten years old give results very little different from four or five years old samples," because those who had to do with districts in which there was much made-soil, as was the case in some parts of Stoke Newington, had often asked themselves the question as to when such soil might be reasonably held to have

gone back into the condition of humus and be suitable soil to build upon. He did not think that the amount of organic matter in the soil affected the question very much. One got, of course, what could be called clean soils showing very great variations in organic matter. The subject on which the President had done useful work, namely, as to the power of certain soils to produce large quantities of carbonic acid, as showing that the fermentation, &c., was still actively progressing, was, he thought, a matter of greater importance, and the bacteriological examination to which Dr. Savage had paid attention was also on the right lines. Dr. Savage pointed out very carefully that his paper was preliminary to a great deal more which he intended to do on the subject, and we should all watch with interest the results of his very useful work.

CONGRESS AT BRADFORD.

JOINT MEETING OF SECTIONS II. & III.

THE STANDARDISING OF SEWAGE.

By W. D. SCOTT-MONCRIEFF.
(Fellow.)

WHEN I was asked to read a paper on the standardising of different kinds of sewage I knew that in acceding to the request I was undertaking a very difficult task. Although considerable advances have been made in our knowledge of the bacterial processes since first they were accepted as a probable solution of the problem of purification I am afraid very few—even among experts—realise how empirical the methods are which are now being adopted.

The time and money which have been thrown away in attempts to apply the experience obtained in the treatment of one kind of sewage to the treatment of another is incalculable. In the aggregate it must amount to millions of pounds. It is my contention that this waste will go on indefinitely unless the subject is put upon a more scientific footing, and in order to do this it is essential, as in all other sciences, that there should be some exact method of measurement that will be applicable to every case. It is quite obvious, I think, that if an engineer does not know with some degree of accuracy what is required he must be working in the dark, and that, if the same ignorance existed in other departments for which the necessary data are to be found in the text-books, he would be building bridges which either fell to pieces or were unnecessarily strong, and designing engines that were either inadequate to the work required from them or wasteful from being too large for their load.

Until this question of standardising is settled it is impossible for the biolytic treatment of sewage to make any satisfactory progress. I will give another illustration. It would be as reasonable to expect progress in

the production of iron and steel while remaining in ignorance of their melting point and of the thermal equivalents of fuel. This analogy is more apposite than at first sight you may suppose, because, just as the melting point of an ore may be spoken of as the measure of its refractory qualities, so the filtering depth under standard conditions required for the nitrification to a required percentage of oxidised to unoxidised nitrogen in an effluent, is the measure of its refractory quality as well. Now what would the position of the iron industry have been if no one had recognised the importance of supplying oxygen in sufficient quantities to insure the combustion of the fuel? And yet oxidation of organic matter is a combustion process just as much as the smelting of iron, and the circumstance that it is carried on by the agency of the life processes of micro-organisms in no way alters the fact. The amount of oxygen required to carry out the re-action experimentally is known. One gramme of nitrogen requires—

For production of	Grains of Oxygen.	Litres of Oxygen.	Litres of Air.
N_2O_5	2·85	2·0	10·0
N_2O_3	1·7	1·2	6·0
N_2O_2	1·13	0·8	4·0
N_2O	0·59	0·4	2·0

And yet in the face of this knowledge not only are bacterial plants being designed without supplying the necessary oxygen, but no attempt, so far as I am aware, is being made to find out what air is required under any standard conditions. Surely it is worth while to enquire: 1st, If standard conditions can be devised? and 2nd, What air is required under these standard conditions to produce any required standard of purity?

In a paper which I read before the Sanitary Congress at Birmingham, I described the apparatus which I used in my Ashtead experiments to discover the chemical changes that occur at different stages of nitrification in a well aerated filter; and this was done by superimposing trays containing filtering material with air spaces between so that samples can be drawn from each. In this way I was able to show the changes diagramatically so that they could be seen at a glance, and the whole of the nitrogen could be accounted for either in mineralised or gaseous forms. The latter were no doubt caused to a great extent by inadequate aeration; this arrangement, from a standardising point of view, had several crucial defects. In the first place it did not embody a design which was practicable upon a large scale, and the larger scale in any case would have materially altered the

conditions. In the next place there was no provision made for measuring the quantity of air necessary for giving any required result. The apparatus it is true could be used for comparing one sewage with another in terms of the Standard Conditions provided by the trays, but if the apparatus was to be of universal application it was necessary that the following conditions should be complied with.

1st. That the testing apparatus itself should be the unit of a type of filter which could be generally used, and is in general use.

2nd. That means should be available for estimating the chemical changes at different depths, as in the case of the superimposed trays, so that the point, where the required standard of purification was reached, could be clearly ascertained.

3rd. That provision should be made, not only for regulating and measuring the discharge in terms of gallons per hour, but also the quantity at each discharge.

4th. That there should be a ready means for altering and noting the periods between each discharge.

5th. That provision should be made for an accurate measurement of the air required for producing the different degrees of purification at varying depths of filth.

Before describing the apparatus which I have designed for these purposes, I will show you of what importance it is to have some such appliance when advising upon the treatment of any particular sewage; and I will presume for the moment that the apparatus does, as a matter of fact, comply with the five conditions I have spoken of as being necessary.

I was called in to advise upon the purification of a sewage which was not normal and to which any experience I had in no way applied. The difficulty of dealing with it was very much in evidence by the complete failure to purify it by methods which are stated to have been successful in other cases. Now, I would like to know what passes through the mind of the average expert when he has to deal with such difficulties under existing conditions. Even in the case of normal residential sewages I maintain that there are no two alike, and though they may be very similar in character as shown by chemical analysis it does not follow that the organisms available for bacterial treatment are by any means the same. But if there is no certainty in the case of sewages that are apparently alike there must be absolute ignorance in the case of sewage which has special characteristics of its own. Has the expert in such a case to assume the air of knowing that of which he is really ignorant, and is he justified in advising his client to spend money in the dark? Nothing is more certain

than failure if the necessary conditions demanded by a purely natural process, working in accordance with the most rigid natural laws, are not complied with. Surely the only scientific, not to say honest, way in which to deal with such a situation is to find out if possible what the necessary factors are and to discover how they may be employed to the best advantage in terms of accurate measurements.

In the case I have referred to, unless I had been able to suggest a method by which the necessary factors could be accurately measured, the only honest course would have been to admit that I was incompetent to give advice of any value whatever. I think therefore it will be generally admitted that such a report is of special interest, because it is an illustration of what other reports should be under similar circumstances, at any rate in principle, whether the methods recommended ought to be generally adopted or not. The following paragraphs in the report will speak for themselves.

I was informed that there had been great difficulties in dealing with the discharge of liquid from certain works, and that only a small proportion of it consisted of ordinary sewage, also that the quantity and character of the discharge varied at different seasons of the year.

Upon this information I made the following observations.

(*a*) An empirical attempt to deal with a discharge of this sort is not likely to be successful.

(*b*) It is quite possible that the experience obtained from the biological treatment of ordinary sewage does not apply in this particular case.

(*c*) The discharge from the works may be wanting as compared with ordinary sewage: (1) in the bacteria that liquefy the organic matter in suspension by a putrefactive fermentation; (2) in the bacteria that nitrify the organic matter in solution under aërobic conditions.

For these reasons I do not think that one is justified in supposing that the treatment applicable to ordinary sewage would necessarily apply in this case, and I do not advise the expenditure of time or money on the supposition that it does.

In view of these considerations I recommend that an independent investigation should be made by means of an apparatus, the object of which is to obtain, on a practical scale and at a trifling cost, reliable data upon which to base conclusions as to the character and dimensions of the plant required for treating the whole of the sewage.

The four principal factors are :—

(*a*) The depth of filter required to produce the necessary standard of purity in the effluent.

(*b*) The quantity of air necessary for the life processes of the organisms.

(*c*) The proper rate of flow per unit of filter bed surface in order to obtain the best results.

(*d*) The best period of rest between each discharge to prevent gelatinous growths in the filtering material.

In conclusion, I said that "the course I recommend is better than launching into experiments involving time, money, and attention without even knowing the reasons for success if you happened to be fortunate in obtaining a good result, which is very unlikely."

Now, I hope that the reports of the future will, at any rate, be of the same type and character as the one from which I have quoted, and that engineers and chemists will be able to base their recommendations upon accurate data obtained by standardising the particular sewage they are dealing with, so that they know exactly where they are before recommending works upon a large scale. They may differ indefinitely among themselves as to the kind of plant they recommend, but at any rate they will know all about the four factors they have to provide for, viz., depth of filter, provision of oxygen, rate of flow, and periods of rest. I think everyone will agree with me that, if this information can be obtained at small expense, it ought to precede and be the foundation of every proposal for spending money, at any rate upon a large scale, on bacterial processes.

Referring to the Tables, I should first mention the conditions I spoke of in connection with the Ashtead experiments, viz., that the apparatus itself should be the unit of a type of filter which can be generally used, and is in general use. A bacterial filter is quite elementary in its simplicity, although it is the home of mysterious and complicated processes. There is, therefore, no difficulty in making use either of a standard material graded to a standard size, or of the actual material which it is proposed to employ in any particular case.

For the standard apparatus, I use hard clean coke gauged to pass a $\frac{3}{4}$-inch mesh and to be rejected by a $\frac{1}{4}$-inch mesh. I do this because the highest ratio of oxidised to unoxidised nitrogen in any effluent that has ever been reached, viz., 98·6 per cent., was obtained from this material in my Ashtead experiments, and I therefore do not think it can be a bad one to select for this important purpose.

For investigations of any particular filtering material, the factors of

Date.

TABLE I.

Parts per 100,000.

Depth of Filter in Feet.	Chlorine.	Free NH_3	Albuminoid NH_3	Oxygen Consumed.	Nitrous Nitrogen	Nitric Nitrogen	Total Oxidised Nitrogen.	Total Unoxidised Nitrogen	Total Organic Nitrogen.	Total Inorganic Nitrogen.	Total Nitrogen of all kinds.	Dissolved Oxygen.	Matter in Suspension.	REMARKS.
0														
1														
2														
3														
4														
5														
6														
7														
8														

Date.

TABLE II.

Parts per 100,000.

A	B	C	D	1	2	3	4	5	6	7	8	9	REMARKS.
Rate of Discharge in Pints per Foot per Hour.	Minutes between each Discharge.	Cubic Feet of Air per Hour.	Depth of Filter in Feet.										
8	8	35	1										
7	7	30	2										Effluent.
6	6	25	3										Percentage Purification %
5	5	20	4										Feet of Filter.
4	4	15	5										Nitric Nitrogen. Nitrous Nitrogen.
3	3	10	6										Total Nitrogen Oxidised
2	2	5	7										Total Nitrogen.
1	1	0	8										A B C D

A, B, C and D on Table II. will always speak for themselves, and if comparison is wished to be made with the coke standard, this can of course be done.

Unit of Surface.

It has been suggested to me that the unit of surface in the testing apparatus should have been a square yard; but I think myself the unit of three square feet is better because it allows of a more practicable arrangement for the measurement of the air, and a sufficient flow of sewage to be capable of accurate regulation. In relation to the rate of flow I am satisfied that the best unit is the square foot for several reasons. In the first place you can have considerable inaccuracy of distribution upon a square yard, but it is a different matter when a contractor is bound down to give accuracy upon every square foot.

Testing Accuracy of Distribution.

If it is suggested that this is difficult to measure on a large scale, the answer is that nothing is easier; a shallow box exactly one foot square is all that is necessary. This is placed upon any part of the bed, more or less at random. If the distribution is due at the rate of 1,000,000 gallons per acre per twenty-four hours, the machine must discharge exactly one pint into the box eight times in an hour. All then that is necessary for an absolute test of accuracy of distribution, is a shallow box one foot square and a pint pot. If the rate of distribution is to be at the rate of 500,000 gallons per acre per twenty-four hours, then half a pint should be discharged, and so on. If further accuracy is required the measure can be taken in ounces, 24, 12, 6, or 3.

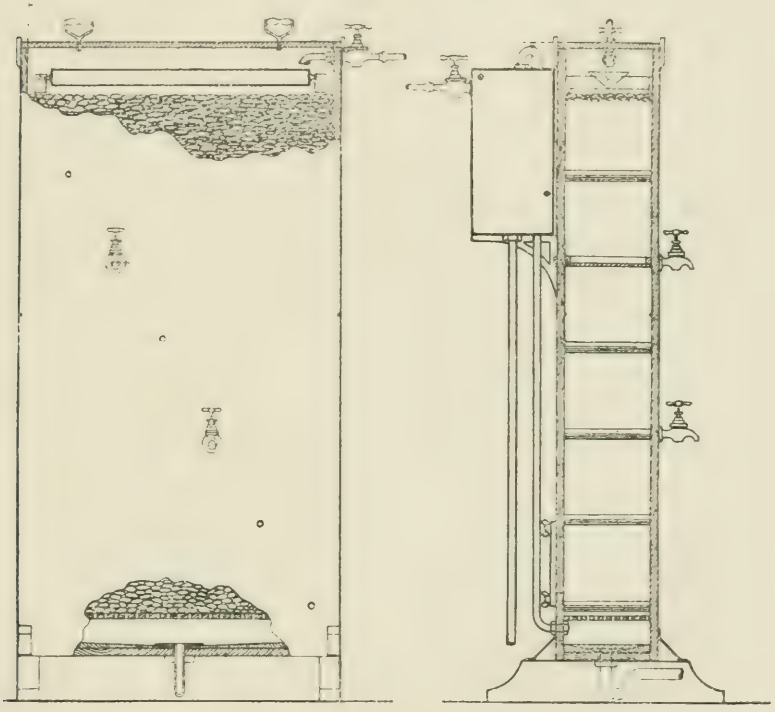
I maintain that accuracy of distribution is an essential element of success, and I do not think the plan I employ to test it is likely to be greatly improved upon.

Of course the distribution of the testing machine is extremely accurate, but equally accurate distribution can be obtained from large machines dealing with great volumes of sewage. For general use I do not see that there is much difference in gallons per yard per hour as a unit or gallons per foot per hour, except that the latter is the more simple of the two. The periods of rest between each discharge apply equally to all installations however large.

I make these observations because it must not be supposed that the dimensions of the apparatus prevent it from being used for calculating factors of the largest installations.

Depth of Filter.

The depth of the filter is, of course, taken full size. I have limited this to six feet, because I am afraid any sewage which requires more depth, under favourable conditions as regards A, B, and C, cannot be economically treated by bacterial methods. Referring to the illustration again, it will be seen that the box contains a unit of filtering material of eighteen cubic feet, with a superficial surface of three square feet. The method of collecting samples is shown on the diagram, provision being made by means of taps fixed in echelon for taking them simultaneously for every foot from one to six.



Distribution.

The great point about the distributing detail is, that it should be capable of being varied at will so that you can tip at the rate of 10,000,000 gallons per acre per twenty-four hours, or 100,000 with every possible variation of time between each discharge. The machine, as you

can see, is simplicity itself, and I will now go on to describe some of the information which can be obtained from it.

Taking the case of a dispute as to the effect of a discharge of trade refuse into a sewer, in which it is alleged that it interferes with successful treatment of the sewage, it is only necessary to have two testing machines started under exactly similar conditions, the one taking the sewage from above, and the other below the point of discharge complained of—the most favourable conditions having been provided for both, if it is found that the sewage below the discharge requires one foot more filter depth than the other, it will be seen at once what a serious additional cost is thrown upon the ratepayers, if this further depth has to be extended over a large area of filter beds, in order to obtain the same results as a bed one foot shallower, in the case of the normal sewage. The two sewages could be then compared for example as follows:

	A.	B.	C.	D.
Normal Sewage	8	7	10	5
Trade refuse sewage	5	8	15	5·5

In other words, in order to give the same standard of purity, the sewage below the point of discharge complained of would have to be plus the difference in every factor, namely, increased filtration area in the ratio of 8 to 5 to make up for the decreased discharge from 8 to 5 pints per foot per hour; under B, one more minute between each discharge; under C, increased air supply in the ratio of 15 to 10; and under D, increased depth of filter bed in the ratio of 5 to $5\frac{1}{2}$.

This is probably not an exaggerated case, and the experiments, speaking for themselves, would place the facts beyond dispute.

Noting Storm-water and other Changes.

For the ordinary purposes of noting changes in the character of a sewage, such as the effects of storm-water, it will frequently be sufficient to note the oxygen-consumed figures alone, as these will be found in most cases to run closely in accordance with the other changes. With the factors A, B, and C fixed at a rate that has been proved to be satisfactory, the variation in the filter depth will be the measure of the change in the character of the sewage.

Estimating the Character and Dimensions of Works.

Perhaps the most important use for the apparatus is to estimate the character and dimensions of the works required for the purification of every kind of ordinary sewage upon the largest or the smallest scale and

to be able to design works, in other words, to take a discharge of 100,000,000 gallons per twenty-four hours, or one of a 1,000 gallons, and purify either of them to any required standard.

For such purposes the following estimations can be made by the use of the apparatus :—

1. Estimation of the depth of filter needed for any required standard of purification with given conditions under A, B, and C.

This estimation is made by simultaneous analyses from all the sampling taps, and the one showing the required standard of oxidation will give the filter-depth required. The rate of air supply, rate of flow, and periods between each discharge should be shown on the air-line, the line of discharge, and the rest-line respectively.

The optimum filter depth will be found in the lowest arithmetical figure in column D, Table II., and this will enable the engineer to specify for any number of gallons for 24 hours for any given sewage.

2. Estimation of the quantity of air required for any desired standard of purification for any given depth of filter.

This is made from estimations by error, starting either with an insufficient or excessive air supply. The rate in cubic feet per hour should be recorded, and also the total number of feet required to produce any required chemical change. By increasing the air supply in the one case and reducing it in the other, a standard air supply can be arrived at and recorded in the air-line on the diagram, Table II.

The optimum air supply is the minimum quantity of air necessary to produce the maximum of purification in the minimum depth of filter.

3. Estimation of the optimum rate of flow for any given sewage.

This is made by adjusting the tap provided for the purpose. The rate of flow may be taken in gallons per hour, or gallons per acre per 24 hours, or parts of a gallon per foot for each discharge. One gallon per foot per hour = 1,000,000 gallons per acre per 24 hours (nearly) = 1 pint per foot every 7·5 minutes. The flow should be observed at intervals by timing the fall of the tipper.

The optimum rate of flow will be the one which gives the lowest arithmetical figures in columns C and D for any required standard of purification.

4. Estimation of the optimum period of rest between each discharge.

This is made by adjusting the weights on the tipping tray. The rest line should be shown on the diagram (Table II.).

The optimum period of rest between each discharge will be the one which gives the standard purification with the lowest arithmetical figure

in column D for the highest figure in column A, *without bacterial deterioration of the filter.*

5. Estimation of the optimum quantity delivered at each discharge.

This is arrived at by the same adjustments as those for the period of rest, an increased quantity being obtained by increasing the weights on the tipping tray, and reversing the operations to decrease the quantity at each discharge.

The optimum quantity will be the one which gives the standard purification for the highest figure in column A with the lowest arithmetical figure in column D. This should be shown by the "discharge" line on the diagram.

6. Estimation of the optimum period of rest in resolving tanks.

This is made by keeping the factors under columns A, B and C (Table II.) constant. Samples of sewage, after different periods of rest in the resolving tank, are then successively passed through the tester and analysed.

The optimum period of anaërobic fermentation will be the one which gives the required standard of purification for the lowest arithmetical figures in columns C and D and the highest in column A.

It is obvious that every condition of filtration as regards air supply can be reproduced in the apparatus.

The period of anaërobic fermentation preceding the nitrification process should be noted in every case.

I propose to adhere strictly to the dimensions and details of the apparatus in every particular, for the purposes of standardising any sewage in terms of the factors A, B, C and D, and I claim for the apparatus that it will place all bacterial processes on a scientific basis.

The following notes may prove useful.

Ratios of oxidised to unoxidised nitrogen ought to refer, not to the ratios between the sewage nitrogen and the final effluent nor between the hydrolised sewage and the final effluent, but to the ratio of the oxidised to the unoxidised nitrogen in the effluent itself. This applies to the oxygen consumed and all other ratios. The nitrogen ratios should be stated under "Remarks" in Table II.

The percentage of purification is the ratio per cent. of the oxidised to the unoxidised nitrogen in the final effluent. This can, of course, be worked out for any other estimation; oxygen consumed, etc. The estimation and the way it is arrived at is shown in Table II.

The convenience of using one square foot as the unit for calculating rate of flow is obvious, from the following:—

1 gallon per foot per hour = 1,000,000 gallons per acre per 24 hours (nearly).

1 pint per foot every $7\frac{1}{2}$ minutes = 1,000,000 gallons per acre per 24 hours nearly.

1 pint per foot every $3\frac{3}{4}$ minutes = 2,000,000.

$\frac{1}{2}$ pint per foot every $7\frac{1}{2}$ minutes = 500,000.

Any rate of flow in gallons per foot per hour is divided by the number of times the tipper falls to give the quantity for each discharge. Example:—When the flow is at 1,000,000 per acre per 24 hours, or a gallon per foot per hour, if the tipper falls eight times in the hour it will give a pint per foot at intervals of $7\frac{1}{2}$ minutes.

The term "optimum" is used to express the best adjustments for obtaining any required standard of purification. The real optimum is not necessarily the one that may be recommended in practice.

I suggest that the universal standard to be adopted should be 90 per cent. of oxidised to unoxidised nitrogen in all effluents, the variations of sewage being arrived at in exact terms by the numerical values under A, B, C, D, required to obtain it.

DR. RIDEAL (London) said that some of those present had already heard practically the same views put forward by Mr. Scott-Moncrieff at the Conference in London of Municipal Engineers, the paper there delivered being subsequently published in the "Public Health Engineer." Mr. Scott-Moncrieff's paper in theory was perfectly sound, but he ventured to say that for working out in practice there were several difficulties. In the first place, it would be noticed that he suggested determining four different factors, a, b, c, and d, given in the diagram, two of which were capable of great variation. Mr. Scott-Moncrieff could bring this apparatus down to a place where works were contemplated, and ascertain these four factors. Everyone was aware that the combinations of four factors were $4 \times 3 \times 2 \times 1$, which gave twenty-four different kinds of variations of a, b, c, and d. But it was something more than that, because each one of these was capable of variation itself. The first one would vary from 0 up to infinity, and if one took the second, third, and fourth, it would be seen that there was a tremendous variation in each one of them. So that not only had you to make twenty-four experiments, but you had to make twenty-four in each one of these different ways, varying the rate of flow, or the interval between the discharge or the quantity of air drawn in, or the depth of the filter. So that the number of experiments necessary to arrive at a solution of the problem in the way suggested by Mr. Scott-Moncrieff would take the engineer, the chemist, and the bacteriologist in charge practically a long lifetime

to work out if all these variations were to be made in a scientific and an accurate way. But there was one problem which he thought underlay the whole of that, and which was mentioned in one of the questions the Royal Commission on Sewage sent round to some of them only a few weeks ago, a sort of examination paper they were asked to fill up. One of those questions he left unanswered, and he thought the majority of them were not yet in a position to answer it. But in a very simple way it was this: Did we at present know whether the conditions of bacterial change in a strong sewage were different from those in a weak sewage? We will take a case where an effluent from a first process gave ten parts of free ammonia, which it was necessary subsequently to oxidise by contact with some continuous filter or with land. After mixing it with an equal volume of river water, diluting the sewage from ten parts to five parts of ammonia per 100,000, an experiment could be made in Mr. Moncrieff's apparatus to see by the amount of oxidisation produced on passing the two liquids through two similar at rates proportionate to the strength would enable an answer to be made. Here you had a certain sewage, you diluted that with an equal volume of water, you passed it through a filter exactly like the other, but you ran it at twice the rate. As the quantity of liquid passing through the filters (at Mr. Scott-Moncrieff's rate of discharge), was double in the one case to what it was in the other, but the quantity of ammonia passing through was the same in both, and therefore, theoretically, the quantity of air required per hour was the same in each case, would the effluents for those two be exactly in the same state of purification? That was the question which the Royal Commission had asked some of them, and he could not answer it. He would like to know whether anyone could throw any light on that particular aspect of the problem. It was the thing that Mr. Scott-Moncrieff's apparatus would solve, but, as he had said before, to do it in detail would take a long time.

Mr. A. J. Martin (Westminster) said the last speaker had given a formidable list of variables with tremendous possibilities of error. He wanted to point out that there was still one more variable which must not be overlooked in connection with questions of that kind, and that was the composition of the sewage, the variations in which were sufficient to vitiate any determinations arrived at, unless the experiments were carried out on a most exhaustive scale. He was quite sure that Dr Rideal, in calling attention to these possibilities of error, did not wish to minimise the value of Mr. Scott-Moncrieff's suggestion, for although, as remarked by the author, the treatment of sewage must be conducted more or less on empirical lines, yet it was a growing necessity that more work of that kind should be done in order that our knowledge of the subject should be placed on as exact a basis as possible. Without attempting to determine all the factors which the author had set out, a great deal of valuable and instructive work might be done by limiting our experiments to one or two of them. But there was one fact that seemed to him to arise out of this discussion, and that was the following:—

You conducted your observations, you arrived at your optimum rate of flow, your optimum air supply, and your optimum depth of filter, and then where did you find yourself? Take the point of the depth of filter. As every engineer knew, in matters of this kind you were limited by the fall available, in the second place, you devised a scheme in the best possible way in accordance with the results arrived at by experiment, and then you went to the Local Government Board and produced your scheme, only to find that the Local Government Board had certain rates of flow and certain filter depths and so on of their own, so that as far as your clients, the local authority, were concerned, the work you had done was thrown away, because you were compelled to follow certain hard and fast lines laid down by the Local Government Board. In saying that he did not wish to cast any reflection on the Board, because their work was one of the utmost difficulty, and it was easy to conceive the position in which a public body of that kind would find itself if it undertook to assess every scheme of sewage disposal on its merits. At the same time, some middle course was required between the present red-tape method of dealing with the thing and a method which took full cognisance of the circumstances of each case, and gave the engineer the credit, and the local authority the benefit of the work that had been done in arriving at a scientific solution of the problem.

Dr. Gilbert Fowler (Manchester) said he had not read the paper with quite the care he should like to give to it, but the first thing which struck him was that, on making the calculations based on the varying factors which had been spoken of, there was one which was more valuable still than any which had been provided for, and that was the condition of the experimental filter. One had to make the calculations as to the depth of the filtering material when one was starting with new material. The experimenter would soon find that under those circumstances he got very different results as regarded capacity and depth from that which would be the case when making experiments with a filter which had been tried and used in one way and another for a year or two. That was a difficulty which was very hard to get over. If the experimenter started with new material each time, he was confronted with the difficulties, which every engineer knew, in the use of material which was not mature. On the other hand, if the same material was used each time, the bacteria would not at once accustom themselves to variations in the character of the sewage. That would be one source of difficulty. In measuring the air supply needed, he might possibly not have understood the process, or rather the way in which it was worked out; but it was necessary to bear in mind that besides the air supply which was drawn in with the streaming effluent, the experimenter had also to consider the air which was drawn in by the activity of the organisms themselves. This was a point which was not always sufficiently realised. They were often told that bacteria beds were deficient in oxygen, but the point which he had mentioned was commonly overlooked. It was amazing with what avidity such

material would take in oxygen, and yet it was impossible accurately to measure the amount taken in in this way. For these two reasons it seemed very difficult to work out a system which would afford the experimenter any guide in a given case in determining the size of works which were necessary. But he did think that Mr. Scott-Moncrieff's apparatus would be very useful for comparative experiments under otherwise identical conditions. For such direct and authoritative tests such an apparatus would be very useful, and he thought that it was in this direction that it would have its application rather than in the elaborate calculation which had been put before them. If he might go on to the point raised by Dr. Rideal, he wished to say that so far as they had been able to tell in Manchester, with several million gallons of storm and sewage water per day, he believed the fact, broadly speaking, was that the rate at which the purification was effected depended upon the actual organic matter in solution rather than on the quantity of sewage put in. There were limits to that, of course; if, for instance, one put sewage on to land, there would come a limit of time when the land would refuse to take even clean water, simply for physical reasons. When, however, one had to deal with an open filter, if the sewage was diluted to half its strength by storm water, one could, broadly speaking, pass through the filter twice the volume per hour that one could of crude sewage. There was another point which arose out of Dr. Rideal's observations. Dr. Rideal asked them to suppose that a certain effluent, produced from the first process, contained a certain quantity of ammonia, which it was necessary subsequently to oxidise by contact with air in some continuous filter or with land; and he asked whether the conditions of bacterial change were different in the purification of the partly purified sewage containing this proportion of albumenoid material from those obtaining when sewage diluted to the same apparent strength had to be further purified. It came to this, whether it was the same thing to dilute sewage to a certain strength, or to purify it to a certain strength. There could be no question that it was a very different thing indeed. If one took raw sewage, and diluted it to bring it within a certain standard, one had not succeeded in purifying it in the least.

Mr. Scott-Moncrieff (London), having been unable to attend, sends the following remarks upon the discussion:—He is glad to have Dr. Rideal's admission that the theory of the apparatus is perfectly sound. He does not agree that in marking out it is defective in any way from a practical standpoint. There is no necessity and no demand for knowing the required depth of filter to a millimeter, or the quantity of sewage per acre to a liter, as had been suggested. Even if that were demanded, he had no doubt but that chemists would be found who were ready to place their services at the disposal of any client rich enough to pay for the information. At present there is no means of obtaining accurate data of any kind, even with a fifty per cent. margin of error. It is blank ignorance all round. Among the many cases that chemists

have been called in to advise upon, there is none in which the necessary factors have been estimated with any accuracy beforehand. What is now being done is attempting to correlate the factors from information obtained from experiments scattered up and down the country, and the time and money being wasted is beginning to be realised. If Dr. Rideal's argument is of any practical significance it means that it is better to go on as we are doing. The factors in the testing apparatus can be varied without expense in less than a minute, but to vary the factors in a large installation might take several weeks and cost hundreds of pounds. For the purpose of standardising no doubt the factors A, B, and C will be arbitrarily fixed. Only one factor will then remain, and instead of the infinite number of variations suggested there will be none at all, seeing that the tap which gives the standard effluent will give the answer required.

He always maintained that the process of biolytic filtration is closely analogous to digestion. All that is required is a knowledge of the conditions necessary for the healthy working of the life processes of the organisms. The amount of food in all cases is regulated by the appetite, and in these bacterial processes we require to have a measure of what the healthy appetite of the organisms is capable of accomplishing. For this purpose the testing apparatus gives chapter and verse in the simplest possible way. Dr. Fowler's remarks refer to conditions which, for the purposes of comparison, will always involve a considerable amount of inherent obscurity. The standards obtained from the testing apparatus must always be qualified by the fact that the results are obtained from the proper bacteria of each individual sewage tested by it. There is no disadvantage in this, because results obtained in any other way must be misleading. The idea of a standard cultivation dealing with different kinds of sewage is absurd, because the standard cultivation would soon be crowded out of existence. All that is wanted is a standard time from the starting of the filter for the samples to be taken and the values of the factors fixed. Some day sewage may be standardised by being sterilised, and then tested by standard cultivations under standard conditions. This will represent the dawn of a bright summer for the chemists, and will no doubt be coincident with filters calculated to millimeter depths and flows to a liter per acre. The testing apparatus will in that case have to be in very competent hands. Meantime we are confronted with a state of complete ignorance, which is involving an endless waste of time and money that can be saved by the use of the testing apparatus. If it enables engineers to design works so as to give an efficiency of say ninety per cent. in some intelligible terms, it will mean a vast improvement upon the present state of things, when the word "efficiency," as applied to sewage installations, is absolutely without a scientific meaning of any kind. The apparatus will of course enable all the points about air supply, referred to by Dr. Fowler, to be cleared up with the greatest accuracy.

THE WORK OF THE WEST RIDING OF YORKSHIRE RIVERS BOARD.

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(Member.)

IN reviewing the work of the Rivers Board at the present time, one is rather at a disadvantage on account of the very able address given by the ex-Chairman of the Board at the last annual meeting, when he described the work done by the Board during the ten years of his chairmanship. Thus I may be pardoned if I here and there follow the lines of his address, quoting the figures given by him.

The Rivers Board was founded in 1893 by a Provisional Order under the Local Government Act, 1888. It is constituted of representatives of the County Council and the six County Boroughs within the West Riding, and has jurisdiction over the streams in the Riding, administering both the general Rivers Pollution Prevention Acts and a special West Riding of Yorkshire Rivers Act, 1894. The total length of streams in the Riding is over 1,000 miles, the area 2,768 square miles, and the population 2,750,493.

The more important of the rivers of the West Riding are those which, rising in the chain of mountains which forms the backbone of the country, flow eastward in approximately parallel valleys, to form, with other tributaries from the North and East Ridings, the Great River Ouse. They are, taking them from north to south, the Ure, the Nidd, the Wharfe, the Aire and Calder, and the Don, and on the extreme south-east there are various branches of the Trent. There are also on the western side of the county the head-waters of the Lune, the Ribble, and the Tame, a chief feeder of the Mersey.

Of these streams the Ure, the Nidd, the Wharfe, the Lune and the Ribble (within the West Riding), and the Trent's tributaries, have never been greatly polluted, and are at the present day clear streams flowing in

natural channels and full of fish life. The scenery in their valleys is amongst the most beautiful within these islands.

The other rivers have at one time been quite as beautiful but not, alas, within the memory of any living. The Don and its tributary the Rother are polluted from nearly their sources with the refuse of mines and the sewage of a large industrial population. For the greater part of the length of the Don neither water-weed nor fish can live in its waters.

The Tame runs for only a short distance within the West Riding, but has on its banks a large number of woollen mills, the refuse of which was until recently poured without compunction into the river along with the sewage of the population of the valley.

But the most degraded and foulest of the rivers are the Aire and the Calder. It was the condition of these two rivers which in great part gave rise to the special legislation of 30 years ago; and to it the Rivers Pollution Commission of 1865 devoted a large portion of their time and a separate volume of their report. The description of the state of the Aire and Calder by the Commission in that report is very valuable and shows as the Commissioners state that the rivers throughout their whole course were then abused, obstructed, and polluted to an extent scarcely conceivable by other than eye-witnesses. "The rivers Aire and Calder and their tributaries" the Commissioners say "are abused by passing into them hundreds of thousands of tons per annum of ashes, slag, and cinders from steam boiler furnaces, ironworks and domestic fires; by their being made the receptacle to a vast extent of broken pottery and worn out utensils of metal, refuse brick from brickyards and old buildings, earth, stone, and clay from quarries and excavations, road-scrapings, street sweepings, etc., by spent dyewoods and other solids used in the treatment of worsted and woollens; by hundreds of carcases of animals, as dogs, cats, pigs, etc., which are allowed to float on the surface of the stream, or putrify on their banks; and by the flowing in to the amount of very many millions of gallons per day of water poisoned, corrupted, and clogged by refuse from mines, chemical works, dyeing, scouring, and fulling worsted and woollen stuffs, skin cleaning and tanning, slaughter-house garbage, and the sewage of towns and houses."

No doubt the state of things in 1893 when the Rivers Board was established was very much worse. The population of the two valleys, which was 944,000 in 1861, had in 1891 increased to 1,563,000. The amount of trade done had increased more than proportionately with the population owing to the introduction of improved machinery and the building of large mills; and the drainage of the towns and the villages,

which had been rapidly extended, carried into the stream hundreds of thousands of gallons of sewage which previously had been received into cesspools or lost by percolation through old stone culverts. The enormous extension of public water supplies too, and the substitution of water closets in place of privy middens, had greatly increased the amount of sewage discharged into the streams. What would have been the present condition of these rivers had no action been taken to prevent their abuse? The population now amounts to 1,699,541, and the trade done is enormously greater.

There are, unfortunately, no detailed reports of the number of houses or mills draining into the rivers of the West Riding available, except what have been obtained since the formation of the Rivers Board. Statistics of populations and of polluting trades and manufacturers in the Aire and Calder valleys are given in an appendix of the 1867 Report of the Commission; but these, unfortunately, are wholly misleading, no distinction being drawn in the case of the populations between those the sewage of which reached the rivers and those whose sewage was discharged on to land or into cesspools. So, too, in the statistics of manufacturers, large numbers are included from whose premises no polluting discharge took place, and the total given of 5,445 manufacturers said to pollute the Aire and Calder, is far greater than the total number now in existence in the whole of the West Riding.

There are now within the Riding 6 County Boroughs, 14 non-County Boroughs, 117 Urban Districts, and 29 Rural Districts; there are 1,983 premises from which liquid trade refuse is discharged, occupied, I believe by every variety of trade carried on in the country from which polluting discharges can arise, with the single exception of whisky distilling; there are some thousands of mills and tens of thousands of dwellings from which solid refuse may be thrown into the streams; and there are thousands of mill dams from which the sludge may at any time be washed out.

From these sources and many others pollution or obstruction of the streams may arise, and the work of the Rivers Board in checking these abuses is no easy task. It is the more difficult in that the habits and practice of generations have to be wholly altered and the people educated to look upon the streams not as convenient channels for carrying off the filth and refuse of mill or dwelling, but as agents for purifying and beautifying the crowded towns on their banks. That may be an idea difficult yet to grasp in relation to our Yorkshire streams, but it is one that daily grows stronger and will ultimately prevail.

The staff of the Board at present comprises the Clerk and Solicitor, the Chief Inspector, with clerks and laboratory, and nine District Inspectors. In the laboratory some 1,500 analyses are made yearly. The total expenditure amounts to £7,000 a year, equal to a rate of one-eighth of a penny in the pound upon the rateable value of the Riding.

In summing up the work done towards the purification of the rivers it must be borne in mind that some of it was begun in the five years preceding 1893 under pressure from the County Council, who, very soon after their establishment in 1888, paid great attention to the pollution of the streams. A little, indeed, had been accomplished even before 1888, but until that date, speaking generally, the Act of 1876 had been in the West Riding as in other parts of the country, a dead letter.

There are now 272 sewage works in operation. In addition to these, 47 complete schemes or extensions of existing schemes are now being carried out or have received the sanction of the Local Government Board; in 26 cases schemes are before the Local Government Board for decision and 20 are under consideration by the Sanitary Authorities.

Of the 14 non-county boroughs only one, Todmorden, is unprovided with sewage works, but a scheme is at present being carried out there. There are 39 Urban districts without sewage works, of which 16 have schemes in progress or sanctioned by the Local Government Board, whilst 11 have schemes in preparation or before the Local Government Board. In one case there is no perceptible pollution, and in two instances the sewage is discharged into tidal waters, whilst in the other two cases the sewage is dealt with by other Districts. In the 29 Rural Districts there are altogether 111 sewage works in operation.

The position of the County Boroughs is unfortunately far from satisfactory, and in the proper disposal of their sewage lies the great difficulty in the Board's work. The six county boroughs have amongst them a total population of 1,410,061. They are responsible for a total discharge of 60 million gallons of sewage daily, including a large proportion of trade refuse, for all of them admit trade refuse to the public sewers. As yet, with the exception of the new County Borough of Rotherham, none of them treat their sewage with anything approaching efficiency.

Bradford has only recently begun to treat the whole of the dry-weather flow, and the treatment adopted so far consists only of chemical precipitation, which leaves 50 per cent. of the impurities in the effluent. The Corporation, under pressure from the Rivers Board, have twice unsuccessfully attempted to obtain powers from Parliament for a large and comprehensive scheme, and have twice been defeated. They have now, however,

been successful in coming to an arrangement with their opponents, and the way is now clear for them to proceed with their scheme.

The sewage of Halifax is at present treated only in septic tanks, but a complete scheme of double-contact beds has been laid before the Local Government Board, whose sanction is daily looked for.

Huddersfield has been unfortunate. In 1895 the Corporation constructed sewage works which were highly praised and held up as a model to visitors from all over the country and from the continent. They were advised by engineers of the highest standing that these works were capable of dealing with the sewage of the town for many years to come, whereas, as a matter of fact, they have never been able to deal efficiently with more than a small proportion of the flow. The Corporation have now prepared a large scheme of extension and are acquiring the necessary site.

The sewage works at Leeds have never been adequate. The sewage is at present treated only by lime precipitation or in open septic tanks. The Corporation, two years ago, purchased a large estate on the River Aire as a site for new sewage works and applied to Parliament for the necessary powers, but owing to determined opposition their bill was thrown out. They are now preparing a further scheme. They have, however, carried out a considerable scheme for the upper part of the borough.

The sewage works of Sheffield were, when they were constructed in 1886, amongst the best of their kind, but the treatment, which consisted of lime precipitation and straining of the effluent by rapid filtration, has now long been recognised as being incapable of giving good results. The Corporation have purchased a large area upon which to extend their sewage works.

Rotherham stands alone amongst the County Boroughs as dealing with its sewage in an efficient manner upon modern lines. Their sewage works have just been completed on the lines of treatment by septic tanks, contact beds and land.

This state of affairs as regards the sewage of the County Boroughs is, therefore, by no means satisfactory at present, but all are actively engaged on the question of the treatment of their sewage, and will not be allowed to rest until they cease to pollute the rivers. The great cause of delay in bringing them into line with the smaller authorities has been the difficulty, insurmountable in some instances, of their obtaining a sufficient area of land of suitable quality for the land treatment of their sewage insisted on by the Local Government Board. This difficulty is now removed by the conclusion arrived at by the Royal Commission now sitting.

The management of sewage works has greatly altered since 1893.

Then it was frequently found that the sewage works were in operation during the day, but at night the sewage was discharged without treatment into the streams. Then, too, after any slight rainfall the sewage was discharged by storm overflows into the stream, and in one case the Sewage Works Manager was even found to be in the habit of turning the sewage by the storm overflow into the stream when he went to dinner, lest a shower of rain should come on in his absence.

Curious excuses for mismanagement or neglect of the sewage works are still given. In one case the manager turned his tank effluent into the stream because it was too bad to go on to the land for treatment. In another case the sewer was flushed to the stream, so as to avoid sending the solids deposited in it into the works.

The Sanitary Authorities are ready with excuses for delay in dealing with their sewage, the most convenient excuse being that the Local Government Board is slow in enquiring into and sanctioning schemes.

It may be mentioned that if the Sanitary Authorities had proceeded with their sewage schemes in 1893, their works would have cost very much less than they have cost during the last few years, or are likely to cost in the future. For instance, the Local Government Board Inspector who held an enquiry into a sewage scheme for Holmfirth in November, 1900, stated that practically the same scheme was estimated to cost £17,000 in 1896, £20,000 in 1897, whereas in 1900 it was to cost £30,000, and will probably cost considerably more before it is completed. The present cost of sewage schemes is further increased by the fact that the interest on loans is now considerably higher than in 1893.

The work of the Board has been exceedingly useful in stopping solid refuse pollutions.

The following is a table of such pollutions found during the last ten years:

Year.	1894-5	1895-6	1896-7	1897-8	1898-9	1899-0	1900-1	1901-2	1902-3
Cases Reported.	164	479	238	236	306	152	122	133	74

It is only rarely now that a manufacturer attempts to get rid of his solid refuse by throwing it into the streams, and the pollutions reported are mostly cases where small quantities of excavated material or house refuse are thrown down the banks of the streams. Especially is this so in country villages where the streams are pure, the inhabitants taking no pride in keeping them clean, but very often throwing into them broken crocks, garden and house refuse; but in a large number of cases owing to the representation of the Board, the Sanitary Authorities have now

provided special tips for such refuse, and are assisting the Board to put a stop to the practice.

One form of pollution by solid refuse arises from the practice of turning the sludge from mill dams into the streams. This is an offence against which certain clauses in the Acts of 1876 and 1894 were specially directed, but by the ingenuity of lawyers these clauses have been to some extent nullified.

There are now 1,983 manufacturers in the Riding from whose premises liquid trade refuse is discharged, and of these 1,019 discharge their refuse into public sewers. In 542 of the remaining 964 cases the manufacturer has adopted some means for preventing the pollution of the river by his refuse. In these cases the means adopted are by no means always satisfactory, but where they are not so at present improvements are constantly being urged by the Board, and in many cases being carried out by the manufacturers. There are still 422 premises from which untreated refuse is discharged to the streams, but in this number are included many places from which very small quantities of refuse are discharged and where the Board has not yet pressed for its purification. It also includes all the cases, and they are very numerous, where the Sanitary Authorities have signified their intention of admitting the trade refuse into the public sewers.

Besides the improvement produced by the construction of purification works, there has been much less solid refuse from manufacturing processes discharged into the streams than was the case in 1893. At that time, for instance, large numbers of the dyers were using rasped woods and chips as dyeing material, and huge quantities of the spent woods were allowed to escape into the streams. In place of these materials the majority of the dyers are more and more using soluble coal-tar colours or extracts, and where woods are used they are now generally strained out of the dye-liquids and disposed of by burning. Many dyers claim that in place of tons a week of solid matters formerly used they are now using pounds. In some cases now it is claimed, and with some truth, that the dyeing materials are exhausted, and that the waste waters discharged to the streams are comparatively innocuous.

Many of the manufacturers who have constructed purification works find it profitable to do so. One paper maker informs the Board that the apparatus he has put into use for the purification of his trade refuse results in a saving of £500 a year, owing to the recovery of pulp which formerly escaped into the streams. A colliery manager states that his works for the purification of the coal-washing water save him each fortnight 300 tons of

coal, which used to be discharged to the streams. One blanket manufacturer estimates that his purification works yield him a profit of 20 per cent., and another large woollen manufacturer has stated that his bye-products give him a profit of £1,000 a year.

One great trouble and expense to manufacturers in connection with their purification works is the disposal of their sludge; but one manufacturer has found a good use for his, as he thinks it is very good for stopping a footpath across his fields.

The excuses for delay given by manufacturers are numerous. One man says he is too busy to give time to the construction of purification works; another man says business with him is too slack. One man says it is of no use his undertaking the construction of purification works whilst those above him on the stream are still polluting; another says it would be useless to purify his refuse, because the next man on the stream below is still polluting. One manufacturer claims that he should not be called upon to purify his refuse, because the stream into which he discharges is a very old one.

One great result of the Rivers Board's work is the education of public opinion. Complaints are now constantly received of abuse of the streams by the discharge into them of solid and liquid refuse, which at one time would have been looked upon as quite natural acts. In many cases where the streams have been freed from former gross pollutions, and by some accident or carelessness a temporary recurrence of the pollution takes place, complaints are at once sent to the Board. Just as in sanitary matters generally we have advanced so rapidly in the last 25 years that we can scarcely credit the tolerance of the last generation of the unhealthy dwellings, the filthy surroundings, and the high death rates then prevalent, so now there is growing up a strong public feeling that the rivers are intended for purposes of health, and not to be used as sewers, and as the streams get gradually purer this feeling becomes more intensified.

The work of the Board has gone on slowly, but steadily, during the ten years since it was constituted. The members of the Board, while keenly recognising the importance of their task, have also felt the difficulty and danger of trying to change the fixed habits and customs of the people too rapidly. The necessary works, moreover, are sometimes costly, and add considerably to the rates of towns and to the expenses of manufacturers. The Board has, therefore, not attempted to force the pace of improvement. At the same time they have not scrupled to put into force the whole of their powers when necessary.

On the whole their efforts have been met with wonderful cordiality,

both by Sanitary Authorities and by manufacturers. The nuisances caused by the pollution of the streams were too patent for it to be otherwise.

In two directions only has there been any attempt at organised resistance. In the one case a combination of millowners defended the ancient practice of sludging out mill dams into the streams; in the other a special combination was formed to defeat the action of the Board in compelling manufacturers to purify their refuse.

In the former instance the dam owners were successful in their opposition in one case, chosen by themselves as a test, but a similar case is now on Appeal to the High Court. If necessary, the law must be altered so as to carry out the evident intentions of Parliament in 1876 and 1894, and to put an end to what the Royal Commission of 1865 described as a palpable abuse.

In the latter instance, a combination of manufacturers in the neigbourhood of Huddersfield and Batley, has attempted to prevent the Board from putting into force their powers of compelling manufacturers to purify their refuse. By the use of every legal quibble imaginable, they have been able to hamper the work of the Board and even to gain temporary successes in the local courts. But they have been invariably unsuccessful before the High Courts, and a series of very expensive defeats has, perhaps, taught them the folly of paying heavy legal and professional expenses in attempting to defeat the objects of a public body which they are at the same time supporting through the rates.

What, may be asked, has been the direct effect of the Board's work upon the streams? The Don, Aire, and Calder are still undoubtedly filthy and degraded, but even these have been immensely improved during the last ten years. It would be impossible now to do as was done in 1865, to write a petition to the Royal Commission using for the purpose water from the River Calder at Wakefield instead of ink, and manufacturers there who make use of the river water find it now so greatly improved that it can be used the whole year round instead of as formerly only when the flow was considerable. The River Aire up to last summer received practically the whole of the untreated sewage of Bradford, and the nuisance it caused in flowing through Leeds was the subject of innumerable complaints. Since then the whole of the sewage of Bradford has been receiving treatment and at least 50 per cent. of its impurities have been prevented from reaching the river, so that never again is it to be expected will the nuisance be so great.

But it is on the smaller streams that the effect of the work done shows

most perceptibly. On such streams as the Worth, the Dearne, and the Hol Beck, and numberless side streams the improvement is very marked, and to many of them fish are returning after an absence of many years.

A most important result of the work of the Board has been the preservation of the cleaner streams from deterioration. The degradation of the Wharfe, the Nidd, the Ure, the Ribble, and the Lune, had commenced, and many serious pollutions by trade refuse and sewage were in existence. All the more serious of these have been stopped, and great care is taken that no fresh pollutions are allowed to arise.

Looking forward for a few years, the prospect of improvement is very hopeful. There can be no doubt but that a few years more will see the sewage of the County Boroughs efficiently purified, and when that is brought about the effect upon the streams will be striking indeed. On the River Aire the removal of the sewage of Leeds and Bradford will bring back the water to such a state of purity that coarse fish at least will be able to exist, and that in times of flood even salmon will be able to pass the polluted part of the river into the cleaner upper reaches. On the River Don the purification of the sewage of Sheffield will remove the source of the grievous nuisance from which the inhabitants of the valley now suffer. In this river, unfortunately, there is a pollution by ochre water from disused mines which will prevent the stream from becoming fit for fish life. On the Calder, although the purification of the sewage of Huddersfield and Halifax will remove in great part the existing nuisance, the vast quantities of waste dye-waters and other chemicals will always be likely to prevent fish life.

I must not be taken as suggesting that the object of the Board is to make the rivers into fishing streams, for the interests of the Yorkshire industries far outweigh any value the fishing at its best might possess, but there are few better tests of the purity of a stream than the presence in it of goodly numbers of fish, and especially of trout and salmon, and to such a degree of purity I am confident many of the streams will in time be restored.

MANUFACTURERS AND THE RIVERS POLLUTION PREVENTION ACTS.

By A. G. LEIGH.

(Member.)

IT is, I believe, no exaggeration to say that, of the good work accomplished through the medium of this Institute in recent years, none stands out more prominently than that associated with the progress of local authorities in their endeavours to comply with the requirements of the Rivers Pollution Prevention Acts. So pronounced, indeed, is this feature in the remarkable success achieved, that one instinctively turns to the other great factor concerned, viz., the manufacturer, with a feeling that, if he is to make corresponding progress, it will be necessary to extend to him a little more consideration.

In reflecting upon the position of the manufacturer some sympathy is due to him, not solely because he has been compelled to make a considerable expenditure of money in the installation and maintenance of the necessary works of purification, but more particularly because he derives no appreciable benefit from that outlay, and is further beset with difficulties which, without scientific aid, he cannot overcome.

The efficient working of the plant of some manufacturers entails a large annual expense, especially considering such collective items as pumping, chemical treatment, filtration with frequent renewal of materials, sludge pressing and disposal, labour, etc. In fact, it is very frequently the case that several individual firms in the same district, besides being heavy ratepayers, are each at greater expense in dealing with their waste liquors than is the whole community of that district in the treatment of its sewage.

No doubt, in the initial stages of the enforcement of the Act, the manufacturer believed that in addition to more wholesome sanitary surroundings he would, in due course, be enabled to turn to the river for

the whole or some portion of his water supply, and thereby secure some sort of compensation as a set-off to the outlay in his purification plant. Instead, however, owing to the existing sources of pollution, he still finds it necessary to have recourse to the local authority's water mains, to put down special plant for purifying the river water before use, or to open out a new source of supply altogether.

There are instances of manufacturers benefiting from the results of the Act, in having been able to gradually diminish their supply from the local authority's mains and return to the improved river water. Such cases, however, are very exceptional, the general rule being that owing to the liability of the river to pollution at any moment it is not to be relied upon, and is safer left alone altogether. During droughts, also, and consequent failure of water supply, the stoppage of works has occasionally been avoided by the availability of the effluent from the treated waste liquors, which has been repeatedly used in the process of manufacture. In fact, even under normal conditions of weather, some manufacturers, who have the only alternative of river water, prefer to use their treated effluent.

In the matter of scientific aid the manufacturer has hitherto been almost entirely left to his own resources, and consequently his progress has not been very marked. The principles followed in the treatment of the various trades' wastes are generally found to be more or less on the same lines. The interpretation of the words, "the best practicable and reasonably available means," can only be decided (according to the Act) by a Court of Law, or by a Local Government Board Inspector. But some manufacturers evidently consider that they are correctly interpreting the meaning of the words by following the example of others, whether the principle is the right or wrong one. It is not unusual to find manufacturers, for want of a little scientific assistance, literally pouring money into the rivers. For example, where chemicals have been used for precipitation, analyses have revealed that the "precipitant" has proved responsible for an increase, rather than a decrease, of both the dissolved and suspended matter. Thus, with regard to capacity of plant, working expenses, etc., a manufacturer may have done all that can be reasonably expected of him; but as to whether that plant is being used to the best advantage or not, is a matter which scientific investigation alone can determine.

Concerning the question of standardising effluents (although a subject which has provoked much warm controversy, and by some considered to be impossible) the manufacturer naturally wishes to know how much further

he has to go. No doubt the relative volume of an effluent, as compared with that of the river into which it is discharged, is a circumstance not to be overlooked in cases of the rivers in the more thinly populated and non-manufacturing districts, where the preservation of fish is perhaps the principal object; but where the water of a river is used and re-used for trades' purposes (as is the case in Lancashire and Yorkshire) and fish life rendered impossible, the fixing of a standard would not be difficult, and is certainly desirable, even if made more exacting from time to time.

A very troublesome question is that of sludge disposal. The phrase "bugbear," as applied to sludge, is now commonly used by the manufacturer, and accumulations in the larger and more congested manufacturing centres are not readily disposed of. The practice of levelling up land with the sludge is to be strongly deprecated. Whether there are any means of profitably utilizing sludge is another matter for scientific investigation. The most economical method of disposal is undoubtedly that of burning. Experiments in this direction have been made on a large scale by a firm of bleachers, and the result was so satisfactory that the erection of a miniature destructor is contemplated. The residual ash, being chiefly lime, proved useful as a land fertilizer. It scarcely needs pointing out that if several firms in close proximity contributed to the erection and maintenance of such works, the individual cost would be trifling. It may be of interest to the paper-maker, using waste stuffs, to know that the writer, with an average sample of dry sludge, produced a gas suitable for driving gas engines, at the rate of 12,000 cubic feet per ton. The fatty substances in an average sample of dry bleacher's sludge produced a gas of high candle power; but the amount was small, being only 2,000 cubic feet per ton. No doubt the fatty wastes from wool-scouring processes would produce a large volume of gas suitable for illuminating purposes, and very probably could be utilized to advantage. A provision might well be made, in any revision of the Statute, to afford facility to the manufacturer to dispose of his pressed sludge by means of the local authority's refuse destructor.

In addition to the foregoing, there are many other important matters calling for scientific attention, amongst which may be mentioned:—methods of recovery of valuable products at present allowed to pass away with the effluent; the best principles of breaking current velocities under different conditions of continuous treatment, and thereby securing the maximum amount of precipitation or sedimentation; the most suitable chemical reagents for precipitating the various trades' wastes; the best principles of, and materials for, filtration. The bacterial treatment of trades' waste

is only in the experimental stage, and manufacturers concerned are, no doubt, anxiously awaiting developments.

A matter of grave concern to both manufacturers and local authorities is that, notwithstanding compliance with the provisions of the Rivers Pollution Prevention Acts, they are still exposed to an action at common law by riparian owners possessing a right to the use of the water of a stream for drinking purposes. Thus, purification works may be installed, and an effluent of good quality (according to present classification) produced; but, if the effluent renders the water of the stream unfit for cattle to drink, a farmer, having the right to the use of the water for such purpose, is entitled to an injunction to restrain pollution (see Gornall *v.* Longridge U.D.C., 1889). It is safe to say that any stream of small volume receiving a considerable volume of trades or sewage effluent, is unfit for drinking purposes, and the question arises—where is the effluent to be discharged to avoid litigation? The manufacturer, or local authority, may offer to divert and convey the effluent by means of a covered channel below the riparian owner's land, or to provide a fresh supply of water altogether, but there are other riparian owners to be dealt with. With the local authority the remedy is not difficult, as the means of supply is generally conveniently at hand. As the establishment of manufactories in any district is beneficial to the local authority, it seems to me that a provision might be made, under such special circumstances, that, in consideration of the riparian owner relinquishing his right to the use of water for that particular purpose, such authority should supply him with drinking water gratis, or at a specially reduced rate. This would not only be an encouragement to manufacturers, but also a protection to the public health.

Referring to the Act:—In section 7, the words "every sanitary or other local authority having sewers under their control, shall give facilities for enabling manufacturers within their district to carry liquids from such factories into such sewers" are followed by so many provisoes, that it seems to be a privilege resting entirely upon the good grace of such authority, and probably (as far as the manufacturer is concerned) the section, as it stands, might well be eliminated from the Act altogether. It will, however, be a source of gratification to the manufacturer that the Royal Commission appointed to enquire into the question of sewage and trades' waste disposal has taken cognizance of this fact, and makes recommendations which, if carried into effect, will afford such facilities as to make this section of the Act unprejudicially workable.

Notwithstanding the expense and difficulties involved, there seems to

be no attempt on the part of the manufacturer to evade the obligations imposed, and little reluctance to comply with the requirements of the Act in any detail. There exists a strong feeling of dissatisfaction, however, and it chiefly lies in the fact that, owing to the weaknesses of the Statute, pollution continues from other sources, which is not only responsible for the undoing of his work, but is also depriving him of what benefit he might derive in a river water supply suitable for his purposes, which—seeing what he has contributed towards that end—he surely has a right to expect.

The sources of pollution may be generally embodied under the following heads :—(1) Sludge from mill lodges; (2) Storm sewage; (3) Mineral matter from mining and other excavations; (4) Sludge impounded behind weirs and dams, and obstructions in the river.

1. Recent legal decisions have taught us that, owing to the unsatisfactory definition of "solid matter," a river may be the recipient of any quantity of sludge (the result of impounding, and frequent replenishment of river water in mill lodges for condensing purposes) provided that no polluting matter has been added to the water whilst so impounded. Thus, a mill-owner may continue to take the river water into his lodge for an unlimited period, until eventually the accumulation of sludge becomes so great and offensive, that, to maintain tolerable sanitary conditions in the environments of his mill, he finds it necessary to clean out the lodge. There being no legal prohibition, he causes a seething mass of decomposing sludge to be tumbled into the river to the detriment of those below him. In the interests of sanitation, and by mutual goodwill towards other manufacturers, it ought surely to be the desire of the mill-owner to make some provision to remedy this evil.

There are many effective and inexpensive means of abstracting the sludge, with little trouble and without nuisance. If it is desired to retain the top water the following scheme would be applicable in most cases :—Excavate the lodge bottom to form a sharp gradient from the sides to some convenient point. Sink a small well at the lowest level, and connect and carry a pipe through the bank, the outlet end being fitted with a screw-down valve. Thus the bulk of the sludge would gravitate to the well, and by means of the valve, with the pressure of the head of water, it could be periodically drawn off into specially prepared drying lagoons ; or, if the physical conditions would not admit of this, into a reception well. In short, the operation would be on the principle of the "Ives Tank." Where it is desired to draw off the top water from the lodge into

the river, for the purpose of renewing the supply, a similar arrangement for dealing with the sludge would answer.

2. Another important factor largely contributing to existing organic pollution is storm sewage, sometimes conveniently designated "storm water." It is very often the case that storm sewage passed into the river as an excess of six times the normal flow (as allowed by the Local Government Board) is much more polluting and objectionable in character than that passing down to the outfall works for treatment. At present, most storm overflows consist of mere sills, the result being that the excess carries with it the floating and lighter organic matters, such as excreta, fats, greases, oils, vegetable substances, etc. To some extent this could be remedied by fixing a scumdip around and parallel to the overflow sill, which would serve to prevent the passage of the floating matter. The only true remedy, however, is in the treatment of storm sewage to a fixed standard; or, at least, to such an extent that the suspended matter would be removed. A rough scheme of screening and quiescent treatment in tanks would generally be found sufficient for the latter purpose.

3. In Section 5 of the Statute, the words "other than water in the same condition as that in which it has been raised or drained from such mine," together with the unsatisfactory definition of "solid matter" and "polluting," leave a good deal to be desired. For instance, in the process of sinking a mine, or in other work of excavation, the drainage usually becomes heavily charged with light mineral matter "in suspension," which as regards the manufacturer, renders the river water injurious to his processes. Within the meaning of the Act, and according to the amended provisions of the recent Bill, it is neither "solid matter" nor "polluting." Where a manufacturer derives his water supply from a small stream, his position, under these conditions, can be readily understood. Such drainage is not difficult to treat, and in the interests of manufacturers it ought to be dealt with.

4. For want of systematic cleansing of the river behind weirs and dams, and the removal of obstructions, its impure condition is maintained, inasmuch as they serve to intercept the impurities from the above-mentioned sources (*vide* "Control of Weirs, etc.," Vol. XXII., Part IV., Journal Sanitary Institute.)

Until legislative measures are put into force remedying the foregoing conditions, the position of the manufacturer will be an anomalous one, and he will continue to regard the Act as a burden and an injustice.

The effect of pollution from these sources does not usually rest with

the nuisance it gives rise to, but is frequently responsible for serious damage to materials in his processes. The bleacher, for example, soils his calico; the printer and dyer find that the use of delicate shades of colour is impossible, or has had to be abandoned altogether; the papermaker discolours his paper, and so on. Thus, the manufacturer witnesses the undoing of his work, not only in the river, but also in his works.

The establishment of manufactories in the chief manufacturing counties, is to-day largely dependent on the quality and quantity of water available; and if, the interests of both existing and prospective trades' development are to be considered and provided for, it is essential that not only should the purity of rivers and water supplies be maintained, but also that they should be rigidly protected against undue encroachment, and accordingly restricted.

In the event of drought, a reserve of stored flood water in the higher reaches of the watershed of a river, as advocated by Professor Robinson, would prove a very valuable asset to the water supply of the manufacturer liable to shortage, besides being more generally suitable for his purposes.

The value of water for trades purposes was clearly demonstrated during the protracted drought of 1901, when several works and thousands of hands were temporarily thrown out of operation. The water supplies, too, of some of our larger manufacturing centres were taxed to the uttermost; and in the event of serious shortage the manufacturer would undoubtedly be the last to receive consideration.

A large amount of trades' capital is being sunk in purification works, and in Lancashire and Yorkshire where manufactories are to be numbered by the thousands, with vast communities dependent on them for their means of livelihood, and where the effect of foreign competition is most keenly felt, it is of vital importance that the burden of the manufacturer be rendered as light as possible, and that any amendment of the Act should aim at the protection of his interests.

In conclusion, I desire to suggest that if manufacturers amenable to the Act were invited to enter into the deliberations of the conferences held by this Institute, for the purpose of setting forth the difficulties of their respective positions, the practical and scientific assistance resulting therefrom would not only serve the interests of sanitation, in the promotion of the efficiency of an important sanitary machine, but also those of trade, in the economical working of that machine.

[*This discussion applies to the papers by* DR. H. M'LEAN WILSON *and* MR. A. G. LEIGH.]

DR. RIDEAL (London) drew attention to a passage in Mr. Leigh's paper in which he said that a proviso might well be made, in any revision of the statute dealing with the prevention of the pollution of rivers, affording facility to the manufacturer to dispose of his pressed sludge by means of the local authority's refuse destructor, in lieu of the local authority dealing with his sewage. He thought this was rather a novel point raised by Mr Leigh which was worth consideration. If the trade refuse was to be excluded from the sewer in the form of liquid, the manufacturer should have the right to give his refuse to the local authority in form of solid to be burnt in the refuse destructor. He fancied the law on this matter stood in the same position as it did in regard to liquid. There was a very clear and definite line between the law as regarded manufacturers' solid refuse and domestic refuse. The refuse of a barber's shop, for example, or a fishmonger's, it was apparently the duty of the local authority to collect and deal with. If the duty of dealing with liquid sewage was shifted from the local authority to the manufacturer, he imagined that it might be made the duty of the local authority to deal with his pressed sludge, but legislation would be required to enable solid refuse instead of liquid to be collected by the authorities. Mr. Leigh also put into his paper a suggestion as to purification works producing an effluent up to drinking water standard. He did not know whether this was the proper question to be discussed at this Conference, but it was a serious matter, for even if the manufacturers were absolved from producing an effluent fit for the drinking water of human beings, he might get into trouble with the agriculturist for not producing an effluent fit for his cattle to drink. This was a point which was receiving the attention of the Royal Commission. Last year he was in Germany, on matters dealing with manufacturers' refuse, and there they had, though the rivers pollution problem had only recently been discussed by the Imperial Authority, a very good line of control. A manufacturer was not allowed to place a mill where he pleased without control, but had to submit a plan to the Imperial Authorities, and then a discussion took place on the nature of the trade effluent, its volume and character, and its effect on the stream; and if it was found that a manufacturer proposed to carry out his scheme on a non-industrial river which was not big enough or suitable to receive such an effluent, then a prohibition against beginning that particular industry was sent down from the Imperial head-quarters, and there was no chance of any fresh pollution arising under that particular scheme. This might with advantage be applied to new problems in this country. But they had still to deal with the old manufactories.

ALDERMAN H. DUNN (West Riding County Council) said he should like to have heard a little fuller discussion, especially on Mr. Leigh's paper, because there was a prospect of early legislation dealing with the matter of trade

effluents, which was a very important one for the community. He might say frankly, that he held very strongly indeed that the local authority should not be placed under the obligation of receiving those trade effluents whether willing or unwilling. There were many districts of comparatively small rateable value which might have planked down in their midst a manufactory, such as, say, a brewery or whisky distillery, where the number of employees was comparatively small, and there would be little increase in the population and the ratepaying capacity of the community, and yet the local authority would have thrust upon it the task of dealing with a large volume of highly putrescible effluent, the cost of the treatment of which would have to be paid out of the rates. That was the case from the point of view of the small districts, and the objections were as great from the point of view of the large districts. Take the city where they were met: Bradford was face to face with a huge difficulty in dealing with trade effluents, but he did not speak as an expert, but as a member of a public body, his own opinion was, that where these trade effluents amounted to any considerable volume, it would be much easier and much more effective and economical to deal with them separately rather than when mixed with the sewage of a large community like Bradford, and what applied to Bradford applied to any other town. He could not agree with the proposition that the cost should be thrown on the local authorities. There were a number of industries in which a solid waste was produced and the manufacturers had to deal with it themselves, and it was absurd to say that the responsibility should be transferred to the community simply because the waste happened to be liquid. He joined issue with the statement in Mr. Leigh's paper that there was no attempt on the part of the manufacturers to evade the obligations imposed. He thought there was a very definite attempt on their part to evade their obligations. Speaking as a member of the West Riding Rivers Board, he could cordially agree with everything in Dr. Wilson's paper. The Board had met with very great difficulties in pressing not only manufacturers but local authorities to deal with their pollutions. No doubt it was an enormous task considering the large number of industries and the very large number of local authorities that had to be dealt with in the West Riding, but as Dr. Wilson claimed in his paper, with a considerable amount of justification, an improvement had already been effected, and if the manufacturers and local authorities honestly tried to do their duty a still greater improvement would result. The Rivers Board did not wish to harass any manufacturer or any local authority, but they certainly did intend that the streams should be purified.

Mr. James Lemon (Southampton) observed that Dr. M'Lean Wilson said the most degraded and foulest of the rivers of the West Riding were the Aire and the Calder. He had an opportunity of seeing those rivers the previous day, and a more disgraceful state of things he never witnessed. He thought something of a more drastic character should be done to prevent the pollution of those rivers by manufacturers' refuse. Although he fully appreciated the work

of the Rivers Board, he thought they did not go far enough. There was a tendency, it seemed to him, rather to accept the excuses of manufacturers than otherwise. When the Institute met at Bolton in Lancashire, some few years ago, he suggested that an iron pipe should be laid down on each side of the river, and the manufacturers' refuse taken down to a given point and there dealt with. There were two ways of getting rid of manufacturers' refuse. Either the manufacturers should deal with it themselves, which he knew was often rendered very difficult by the very small area of their works, or they should combine together and take it down to a given point, where it could be dealt with separately and distinct from the sewage. He thought he could suggest another method. Parliamentary powers could be obtained to compel manufacturers to deal with their effluent, and also to enable local authorities to levy what he would call a refuse rate. The local authorities could then deal with the refuse separately, and levy a rate upon the manufacturers for the cost. He thought that would get rid of the difficulty which now existed, which was really due to the want of combination on the part of the manufacturers, and the disinclination of many of them to do anything if they could possibly help it. As a resident in the South of England, he held that a manufacturer who polluted a river, as was done in this district, was committing a nuisance, and he ought to be dealt with as a man committing a nuisance. He had no hesitation in saying that in many parts of England if the pollution that was going on in the rivers Aire and Calder were attempted an injunction would be applied for in less than a month.

Mr. F. Goodall (Marsden) said he came from a place at the top of a stream. What would be the effect upon the stream if the mill-owners were allowed to draw their water supplies from the stream and turn their effluent into the sewers? How would the second mill be affected, and the third mill? Before the stream had gone past more than a few mills there would not be a drop of water left either for a boiler or for dyeing, or anything else. He contended that the people below had an equal right with the people up stream to the water. Then what would be the effect upon property of such a system? A piece of land was valuable for mill building, but who would think of building a mill on that land when the river had been robbed of all its water? The land, instead of being valuable, would become not worth twopence for mill building. He contended that every man ought to treat his own trade effluent. It could surely be treated better when it was of one kind, rather than when it was mixed with other trade effluents and domestic sewage in the sewers.

Alderman Gibbons (Wolverhampton) hoped that the scientific gentlemen who were called upon to give evidence and advice to the Government would ask the Government and impress upon them the desirability of making legislation the same all over the country. He wanted the same legislation applied to tidal

rivers that applied to inland rivers. No manufacturer should be allowed to turn into a tidal river or the open sea an effluent which was not allowed in a midland town. There was a tendency to remove works from inland towns and to take them to the estuaries so as to get away from the necessity of treating trade effluent. He asked that the Government should be advised to make legislation equal all round so as to stop this tendency.

Mr. Douglas Archibald (London) said it might comfort Alderman Gibbons to know that the oysters were settling this point. Estuarial rivers were now looked upon with suspicion by the lovers of oysters, and there was a tendency to go in for a higher purification, bacterial as well as chemical, because rivers themselves might carry infection to the oyster beds. So he dared to say that the legislation would soon apply all round, much more than in the past.

EXPERIMENTAL TREATMENT OF SEWAGE CONTAINING TRADE WASTE AT HUDDERSFIELD.

By K. F. CAMPBELL, M.Inst.C.E.

IT is now about eight years since the bacterial method of sewage purification first came into prominence by the publication of Mr. Dibdin's report upon the experiments conducted at Barking Creek and Sutton, and although far more attention has been paid and money spent since then than formerly, by local authorities, who have engaged the best of England's scientists, biological, chemical, and engineering, to help in the elucidation of this most important problem, there are still many diffi-difficulties to be contended with. These difficulties are perhaps more of a minor practical character than of principle, and in the interests of this question must have most careful consideration before the economical advantages of bacterial agency are realised and developed.

There can be no doubt that in many respects the results of bacterial methods were at first overstated for the bacterial contact beds and also the septic tank, two of the most valuable agencies in connection with modern sewage works. It was claimed that both were capable of disposing of all the sludge as it formed. Experience has proved that these claims must be modified, and that crude sewage must have some preliminary treatment before it can be applied to contact beds without danger of their losing capacity, and also one must be prepared for the removal of the sludge which, although reduced in quantity, is never absent from any bacterial treatment.

The reputed power of bacteria to perform all manner of functions has undoubtedly been over estimated, and to such an extent have the doctrines been advocated, that it is difficult to remove the impressions which have been conveyed as to the application of these organisms.

It is not the author's intention to minimise the importance of the many actions caused by bacteria, and although the earlier statements led

in some cases to disappointment, they induced many to experiment who probably would not have done so. Not only did they cause many to experiment, but to do so in the right direction to the wholesale abandonment of fancy precipitants and methods of filtration then in vogue.

As the characters of the sewages from towns and villages differ, so also must the methods adopted for their purification. On that account the precautions necessary at one place will be quite unnecessary at another. Theories and rules formulated from experience with one sewage cannot be applied to all sewages, and whilst one process is efficient and economical at one town, it would be quite the reverse in another. I believe it is now generally recognised, that an investigation into the character of the sewage must be made before a method for its purification is decided upon.

The sewage of Huddersfield contains a comparatively small proportion of domestic sewage, owing to the extensive use of the dry conservancy system, the admission of manufacturers' effluents, chiefly woollen, together with a considerable quantity of surface water, which finds access into the sewers. For these reasons it cannot be expected that the bacterial reactions which take place in ordinary domestic sewage, should do so with the same vigour and completeness in the Huddersfield sewage, and briefly this is what has been the author's experience during the past five years.

The experiments which are being conducted at the Huddersfied Outfall Works, Deighton, are carried out upon biological principles, although in one of the systems introduced, chemicals are added as a preliminary treatment. The experiments comprise the following methods of purification :—

1st.—Double contact of the raw sewage in bacteria beds.
(Experiment concluded).

2nd.— Chemical precipitation and double contact.

3rd.—Open septic treatment and double contact.

4th.—Open septic treatment and trickling bed.

For the first of these methods of purification, that of the double contact of the raw sewage, two beds were constructed, a coarse and a fine. These were charged either once or twice a day and allowed to rest on Sundays. Other periods of rest were also afforded them.

This method of treatment was abandoned after a trial extending over twenty months, as it was then evident that it was not a process which could be adopted, owing to the rapid choking up of the coarse bed and to the separate treatment of the strong sewage from the weak, which must, necessarily take place by this system, producing a very variable effluent.

Whilst this experiment could not be considered a success as a method of purification, it demonstrated that it was possible for bacteria to reduce to a very considerable extent the noxious constituents of the sewage, and to transform the sludge into an innocuous, earth-like substance.

The averages of the analyses made in connection with this experiment are as follows:—

	Parts per 100,000. Albuminoid nitrogen.	Oxygen absorbed from $KMnO_4$ in 4 hours.
From August 22nd, 1898 to March 21st, 1899:—		
Raw Sewage	·512	9·94
Coarse Bed Effluent	·182	3·31
Fine „ „	·105	1·94
Purification. Raw Sewage = 100 ...	79 per cent.	80 per cent.
From March 22nd, 1899 to Feb. 23rd, 1900:—		
Raw Sewage	·549	10·24
Coarse Bed Effluent	·176	3·61
Fine „ „	·110	2·14
Purification. Raw Sewage = 100 ...	80 per cent.	79 per cent.

During the 80 weeks which the beds were in operation, the coarse bed lost 75 per cent. of its capacity.

In the second method of purification, that of chemical precipitation and double contact, the chemicals (lime and copperas) are as a rule added to the sewage during the daytime only, between the hours of 8 a.m. and 7 p.m., to assist in the separation of the suspended matter and to precipitate soaps, dyes, etc., from the sewage. Very little advantage, if any, is to be gained from adding chemicals to the sewage during the night time and week end. The average quantity added to the sewage is 2·6 grains of lime and 2·2 grains of copperas per gallon. The time allowed for the sewage to flow through the tanks is six hours.

The results obtained by single and double contact of the tank effluent are as follows:—

	Parts per 100,000. Albuminiod nitrogen.	Oxygen absorbed from $KMnO_4$ in 4 hours.
From July, 1900, to March, 1901:—		
Tank effluent	·218	4·59
First contact bed effluent. No. 10 ...	·096	1·93
Second „ „ ...	·059	1·11
Purification. Single contact	56 per cent.	58 per cent.
„ Double „	73 „	76 „

From March, 1901, to March, 1902 :—		
Tank effluent	·306	6·4
First contact bed effluent. No. 7 ...	·141	2·64
Second „ „ ...	·084	1·46
Purification. Single contact	54 per cent.	54 per cent.
„ Double „	72 „	77 „
From March, 1902, to March, 1903 :—		
Tank effluent	·295	6·00
First contact bed effluent. No. 7 ...	·142	2·61
Second „ „ ...	·083	1·33
Purification. Single contact	52 per cent.	56 per cent.
„ Double „	72 „	78 „

By the addition of lime and copperas and the settlement of the sewage in tanks, as previously described, the impurities are reduced about 50 per cent. if measured by the four-hours' oxygen-absorption test.

The purification effected by the first contact beds on the tank effluent varies according to the length of time which the beds have been in operation, and this may be accounted for by the decrease of capacity which slowly but continually takes place, owing to the deposition of matter on the clinker in the bed, thereby reducing the size of the interstices. The deposit on the clinker retains part of the sewage after the bed has been discharged, and during the aeration period it becomes highly oxidised, and has most probably not only the power of diluting the fresh sewage which enters the bed, but of oxidising it. Thus, as the deposit increases and the size of the interstices decreases, the relative volume of highly oxidised sewage to the fresh sewage becomes greater, resulting in an improvement of the quality of the effluent.

The percentage purification effected by the first contact bed (No. 10) has been as follows:—

1898	49 per cent.	(4-hours'	oxygen	absorption	test).
1899	51 „	„	„	„	
1900	58 „	„	„	„	
1901	59 „	„	„	„	
1902	62 „	„	„	„	

The total purification effected by chemical treatment and double contact has been as follows:—

Year.	Albuminiod nitrogen.	Oxygen absorbed from $KMnO_4$ Hours.
1900	86 per cent. ...	87 per cent.
1901	87 „ ...	88 „
1902	87 „ ...	88 „

The nitrogen existing as nitrates and nitrites in the sewage and effluents have been determined periodically, and the averages of the results are as follows:—

	Parts per 100,000. Nitrous and Nitric Nitrogen.
Raw sewage	·16
After single contact	·27
After double contact	·61

From these figures it will be seen that the raw sewage contains small quantities of nitrates and nitrites, which are derived from the surface water as well as from trade refuse. A slight reduction of the nitrates and nitrites takes place in the settling tanks, more so in hot dry weather, than in cold wet weather. The nitrification which takes place in the first contact beds is very slight, in the second bed it is more decided, although it can be only be considered as small.

The average amounts of suspended solids in the raw sewage and various effluents were as follows:—

	Parts per 100,000 Suspended Solids.
Raw sewage	34·1
Tank effluents	7·0
After single contact	3·4
After double contact	2·1

The amount of suspended matter remaining in the tank effluent is 7·0 parts per 100,000, but with tanks designed for the continuous settlement of the sewage, this amount could be reduced. I consider it of the greatest importance to obtain a tank effluent as free as possible from suspended matter. To remove the suspended matter altogether is practically impossible, as the last traces are finely divided and of the same density as water, therefore they are very difficult to remove by subsidence.

The Huddersfield sewage contains considerable quantities of fat and grease, chiefly wool fat. These have been estimated during a period of dry weather with the following results:—

	Parts per 100,000 Total fatty matter.
Raw sewage	29·0
Tank effluent	4·3
After double contact	1·0

When the sludge formed in the tanks is pressed, the resultant cake, when dried at 105° C. contains 21·4 per cent. of fat.

Out of 327 samples of the effluent after chemical treatment and double contact, submitted to the incubator test, 23 (or 4 per cent.) became putrescent.

The records of the capacity of the beds reveal the fact that there is a continual decrease, due to finely-divided suspended solids finding their way into the beds. These solids contain a high percentage of siliceous matter, iron, alumina, &c., bodies not reducible by bacteria, and which accumulate between the pieces of clinker. By having the surface layer composed of fine material, a large quantity of the suspended matter will be retained by it, but if the material is too fine it clogs very rapidly, and does not allow the tank effluent to pass through it.

For the purpose of determining whether it was possible to maintain a certain capacity by this means, one of the tanks was altered so that the tank effluent would be as free from suspended matter as possible, and the bed was constructed with a surface layer of fine material in order to strain the tank effluent as it flowed into the bed. After being in operation fifteen months it continued slowly to lose its capacity, which is at present 31 per cent. of the space occupied by the bed.

All the beds are charged three times a day, six days per week, the time allowed for the various operations being as follows:—

Filling	... ...	3 hours.
In contact	... ...	5 or 6 hours.
Emptying	... ...	3 hours.
Aerating	... ...	12 or 13 hours.

During the purification process by the third method, that of open septic tank and double contact bed treatment, the sewage is allowed twenty-four hours in which to pass through the tank and it travels eighty feet in doing so.

During the two years and eight months which the tank has been in operation the sludge has been removed twice, and will be removed again in the course of a week or two.

After the septic action has set up and the fermentation of the sludge at the foot of the tank becomes more energetic, the amount of suspended matter in the tank effluent increases and continues to do so as the sludge accumulates and the ebullition of gas becomes more frequent.

The average amount of suspended matter present in the tank effluent during the

First 6 weeks was	... ...	6·6	parts per 100,000.
the 23rd to 26 weeks	...	12·4	„ „
and the 40th to 44th weeks		23·3	„ „

The tank had been in operation eleven months when it was sludged for the first time. The amount of sewage passed through it during that period was 15,232,000 gallons.

By multiplying the number of grains per gallon of solid matter in the raw sewage and tank effluent by the number of gallons treated, month by month, and deducting the one from the other, the amount of matter retained by the septic tank has been calculated with the following results:—

	Tons of matter retained by tank.
From suspension	13·261
From solution	1·811
Total	15·072

When the clear top liquor was run off by means of a floating arm, there remained twenty-eight inches of sludge in the tank. The weight of this sludge was 107·88 tons and it had a specific gravity of 1·039. If it had been dried at 105° C., the solid residue would have weighed 9·385 tons.

The amount of solid matter retained by the tank during the eleven months was calculated as 15·072 tons, and the amount found in it when the top liquor was run off, was only 9·385 tons, therefore, 5·687 tons or 38 per cent. had been disposed of by septic action.

Analyses of the sludge removed from the septic tank in May, 1901 and in April, 1902, are as follows:—

Sludge dried at 105° C.	Collected May 31st, 1901.	Same after 17 months' exposure.	Collected April 24th, 1902.
		Per cent. of dry sludge.	
Volatile matter—			
Fat	—	2·88	15·0
Organic nitrogen ...	—	1·73	2·0
Other matter ...	—	32·15	31·3
Total volatile matter..	47·1	36·76	48·3
Mineral matter or ash total.	52·9	63·24	51·7
		Per cent. of ash.	
Siliceous matter ...	65·40	65·58	61·12
Lime (CaO) ...	6·23	5·88	4·90
Iron (Fe_2O_3)	9·53	8·87	13·78
Alumina (Al_2O_3) ...	10·55	11·10	11·73
Phosphoric Acid (P_2O_5) ...	1·03	·99	1·43

The two contact beds for the purification of the septic effluent are constructed at such levels as permit the contents of the first to flow by gravitation on to the second.

The primary bed of coarse clinker, varies in size from 1 to 3 inches, with a layer of fine material over a portion of the surface upon which the sewage flows when the bed is filling, which prevents a large amount of suspended matter from entering the body of the bed. The average depth of the bed is 3 feet 9 inches.

The secondary bed is composed of clinker varying in size from $\frac{3}{16}$ths to 1 inch, with a layer of finer material upon the surface.

Averages of the analyses, made regularly, of the raw sewage, tank effluent and contact bed effluents, are as follows:—

	Parts per 100,000. Albuminoid nitrogen.	Oxygen absorbed from $KMnO_4$ in 4 hours.
From August 1900 to March 1901.		
Raw sewage	·406	8·80
Septic tank effluent	·254	5·06
First contact bed effluent	·138	2·83
Second contact bed effluent	·093	1·64
Total purification. Raw sewage = 100	77 per cent.	81 per cent.
Purification effected by double contact.		
Tank effluent = 100	62 „	67 „
From March 1901 to March 1902.		
Raw sewage	·673	12·03
Septic tank effluent	·342	7·21
First contact bed effluent	·172	3·61
Second contact bed effluent	·121	1·99
Total purification. Raw sewage = 100.	82 per cent.	83 per cent.
Purification effected by double contact.		
Tank effluent = 100	65 „	72 „
From March 1902 to March 1903.		
Raw sewage	·582	10·47
Septic tank effluent	·306	6·07
First contact bed effluent	·176	2·84
Second contact bed effluent	·095	1·5
Total purification. Raw sewage = 100.	84 per cent.	86 per cent.
Purification effected by double contact.		
Tank effluent = 100	69 „	75 „

During the slow passage of the sewage through the open septic tank about 40 per cent. of the impurities are removed, as measured by the four hour's oxygen absorption test, of which 33 per cent. are from suspension and 7 per cent. from solution.

By single contact the reduction of the impurities in the tank effluent has been as follows:—

1900	...	44 per cent.	(4 hours' oxygen absorption test)
1901	...	50 „	„ „ „ „ „
1902	...	54 „	„ „ „ „ „

The total purification effected by the septic tank and double contact has been as follows:—

Year.	Albuminoid nitrogen.	Oxygen absorbed from $KMnO_4$ in 4 hours.
1900 ...	77 per cent. ...	81 per cent.
1901 ...	82 „ ...	83 „
1902 ...	84 „ ...	86 „

During warm weather, and at a time when the sewage is not diluted with surface water, the small amount of nitrous and nitric nitrogen present in the sewage disappears in the septic process. Very little nitrification takes place during the first contact, and although a more marked nitrification occurs during the second contact, the amount present in the effluent is much less than would be expected.

The average of a number of determinations is as follows:—

	Nitrous and nitric nitrogen. Parts per 100,000.
Raw sewage	·27
After single contact	·29
After double contact	·51

The effluent from the ordinary form of septic tank contains a considerable quantity of solid matter in suspension, which it would be most desirable for it to be free from. With specially designed tanks, however, I believe that this could to a great extent be avoided.

In the effluent from the coarse bed there are 6·4 parts per 100,000 of suspended matter which should be intercepted before it flows into the fine bed.

The average amounts of suspended solids in the raw sewage and various effluents were as follows:—

	Parts per 100,000. Suspended solids.
Raw Sewage	32·3
Septic tank effluent	13·1
After single contact	6·4
After double contact	1·9

The total fat present in the crude sewage-tank effluent and fine-

bed effluent, was estimated during a spell of dry weather, with the following results:—

	Parts per 100,000. Total fatty matter.
Raw sewage	28·94
Septic tank effluent	7·63
After double contact	1·99

By comparing the above figures with those relating to chemical treatment, it will be seen that the tank effluent from the latter process contains 43 per cent. less fat than the septic tank effluent.

The sludge in the open septic tank, when dried, contains 15 per cent. of fat.

From October, 1900, to March, 1902 (eighteen months), 253 samples of the final effluent were submitted to the incubator test, with the result that 144, or 57 per cent. of the samples became putrescent.

From March 1902 to March 1903, out of 189 samples tested, 47 or 25 per cent. became putrescent during incubation.

With regard to the capacity of the coarse contact bed, during the first eight or nine months after it had been put into operation, its capacity rapidly diminished. However, during the past year the loss has been but slight. As the open septic tank effluent contains a very considerable quantity of suspended matter it would naturally be expected that the loss of capacity which at present takes place would be much greater than it actually is. The fine material, through which the effluent flows upon entering the bed, arrests a considerable amount of the suspended matter, as can be evidenced by the foul and clogged state into which the fine material gets after working a few weeks. Also a certain amount of the irreducible matter comes away from the bed in the form of suspended matter in the effluent, the quantity of which has already been given.

The coarse contact bed has already been in operation two years and seven months and has a liquid capacity of 25 per cent. of the space which it occupies.

In the fourth method of treatment the septic effluent is purified by means of a trickling bed instead of by double contact as in the preceding experiment.

With regard to the term "trickling bed" this is often known as a "continuous filter," a somewhat misleading name, as the action of the bed is not that of a filter, and it is not worked continuously, but intermittently.

The trickling bed at Huddersfield Outfall Works is constructed upon a

slightly inclined brick floor and is drained by 10 inch half pipes containing 1½ inch perforations.

The bed is 7 feet high, the lower 3 feet consisting of clinker rejected by a 2 inch screen, whilst the upper 4 feet consists of clinker rejected by a 1½ inch screen.

The clinker is supported by brick pigeon-holed walls to a height of 3 feet 6 inches, and above this height large pieces of clinker are stacked one upon another, as nearly vertical as possible, so as to serve instead of walls.

The bed is octagonal, 37 feet in diameter. It has an area of 117 square yards and a cubic capacity of 278 cubic yards.

The level of the sewage in the open septic tank is generally 16 inches above the bottom of the arms of the sprinkler and 18 inches above the surface of the clinker in the bed.

Until recently a leakage at the centre of the sprinkler caused considerable trouble and rendered many of the analytical results unimportant. At first it was considered that it would not appreciably affect the results, and a tray was fixed for its distribution. However, upon the leakage being conveyed in a separate pipe away from the bed, it was found to be nearly one-sixth of the total volume of sewage applied to the bed, and by its diversion the effluent was considerably improved.

The action of the trickling bed upon the septic sewage is very remarkable, especially when the short length of time—under 15 minutes—which the sewage occupies in passing through it, is taken into consideration.

The suspended solids in the septic sewage are partly heavy, and will settle in the course of an hour or so, and partly light and finely-divided, forming a dense turbidity, and one of the effects of the bed is to cause these suspended solids to coagulate and form granular matter, which can be readily separated from the effluent which it leaves quite clear.

The effect upon the organic matter in solution is also very noticeable, as it is reduced to a greater extent than in double contact beds, a process which occupies 6 or 7 hours. Nitrification takes place to a much greater extent in the trickling bed than in the contact beds, and the effluent when subjected to the incubator test has, so far, never failed to stand the test.

The averages of analyses made of the raw sewage and effluents during the past week will serve for the purpose of comparing the three processes, and are as follows :—

	Ammoniacal nitrogen.	Albuminoid nitrogen.	Oxygen absorbed from $KMnO_4$ in 4 hours.			Nitrous and nitric nitrogen.	Chlorine.
			Suspd.	Sol.	Total.		
Raw Sewage	1·23	·674	6·13	4·99	11·11	·19	15·4
Chemical treatment and double contact	·105	·101	·16	·96	1·11	·69	14·4
Open Septic treatment and double contact ...	·15	·121	·33	1·06	1·39	·33	14·9
Open Septic treatment and trickling bed	·13	·090	·10	1·01	1·11	1·14	14·9

In making a comparison of the quantity of sewage which can be purified on a given area by the various processes, the first method, that of the treatment of the crude sewage in contact beds, is omitted, as the quantity dealt with by the coarse bed diminished too rapidly to be taken into serious consideration.

The following calculations are based upon the latest record of the capacity of the beds, and No. 7 bed is taken as representative of the first contact beds after chemical treatment.

With a fall of 8 feet 6 inches deep, the contact beds, primary and secondary, could be 3 feet 6 inches deep, the remaining 18 inches being required for the distribution of the tank effluent on to the primary beds, and for the draining of the effluent from the primary beds and its distribution on to the secondary beds. In the case of the trickling bed, the bed could be 7 feet deep, allowing 18 inches head of sewage to work the sprinkler.

	Chemical Treatment and Double Contact. Gallons.	Septic Treatment and Double Contact. Gallons.
Capacity of Tank.		
1 acre 3 feet 6 inches deep ...	950,000	950,000
Present capacity of first contact beds as compared to the empty tank	31 per cent.	25 per cent.
Ditto of second contact beds ...	33 per cent.	33 per cent.
Sewage Treated per Day when Beds are Filled Three Times.	Gallons.	Gallons.
By first contact beds	880,000	710,000
By second contact beds	940,000	940,000
Area required to Treat One Million Gallons of Sewage.		
First contact beds	1·14 acres.	1·41 acres.
Second contact beds	1·06 „	1·06 „
Double contact	2·20 „	2·47 „

When the sprinkler is in operation, it applies 1,930 gallons of sewage to the bed per hour. The sewage is sprinkled on to the bed sixteen hours per day, and therefore deals with 30,800 gallons daily, a quantity equal to 1,250,000 gallons per acre. To treat one million gallons per day, ·8 acres of beds would be required.

In practice, however, a slightly greater area of land would be required than that actually occupied by the beds owing to their circular or octagonal form, and some of the unoccupied spaces could be utilised for the construction of small conical or other suitable tanks for the separation of the suspended matter in the effluent as it flows from the beds.

Area of beds required by the various methods of treatment:—

Method of Treatment.	Acres of beds required to treat one million gallons of sewage.
Chemical precipitation and double contact ...	2·20
Open Septic and double contact...	2·47
Open Septic and Trickling bed	·80

Having described as briefly as possible the experiments conducted during the past five years at the Huddersfield Sewage Purification Works and their results, the author, before making a comparison of the various processes, desires to state, that in conducting these experiments he has not been biassed in any way. He did not pin his faith to septic tank, chemical treatment, contact beds, or trickling beds, and he has brought forward to the best of his ability both the defects and the merits in each case, without unduly lauding anyone of them.

The author has always been in favour of land treatment, the most ancient and yet most efficient method of dealing with sewage. It is an ideal biological process, and very fortunate are those local authorities who can obtain suitable land at reasonable cost, as the power of land, when skilfully managed, to purify sewage has been fully proved by years and years of trial. Unfortunately there is a large number of towns where, from one cause or another, suitable land is unobtainable. At Huddersfield as well as in other towns the hilly nature of the surrounding country and other causes renders land treatment out of the question, and on that account there is no alternative but to adopt some artificial medium instead of soil, nature's medium, by which the sewage can be purified on a far smaller area of land, with but slightly less satisfactory results. All artificial processes are far from being perfect. Each has its defects more or less, and it is only by careful investigation extending over a long period of time that it is possible to determine the system to be applied to any particular locality.

It is now generally admitted that similar results may be obtained by the use of an open septic tank, as with a closed one. The author strongly emphasizes this view, and trusts we shall hear less of the closed tanks in the future, at any rate in the case of large manufacturing towns.

Where the septic treatment of the sewage is adopted, a very much larger tank accommodation is necessary, the sewage having to remain in the septic tank twenty-four hours more or less, whilst five or six hours is sufficient for chemical treatment and sedimentation. The larger tank capacity necessary in the septic process has the advantage of allowing a mixing of the strong day sewage with the weak night sewage, which is of great importance under the existing conditions.

Should, however, the recommendations of the Royal Commission become law, and the manufacturers be compelled to allow their waste to flow into the sewers over an extended period, then the septic tank would have but a slight advantage over sedimentation tanks.

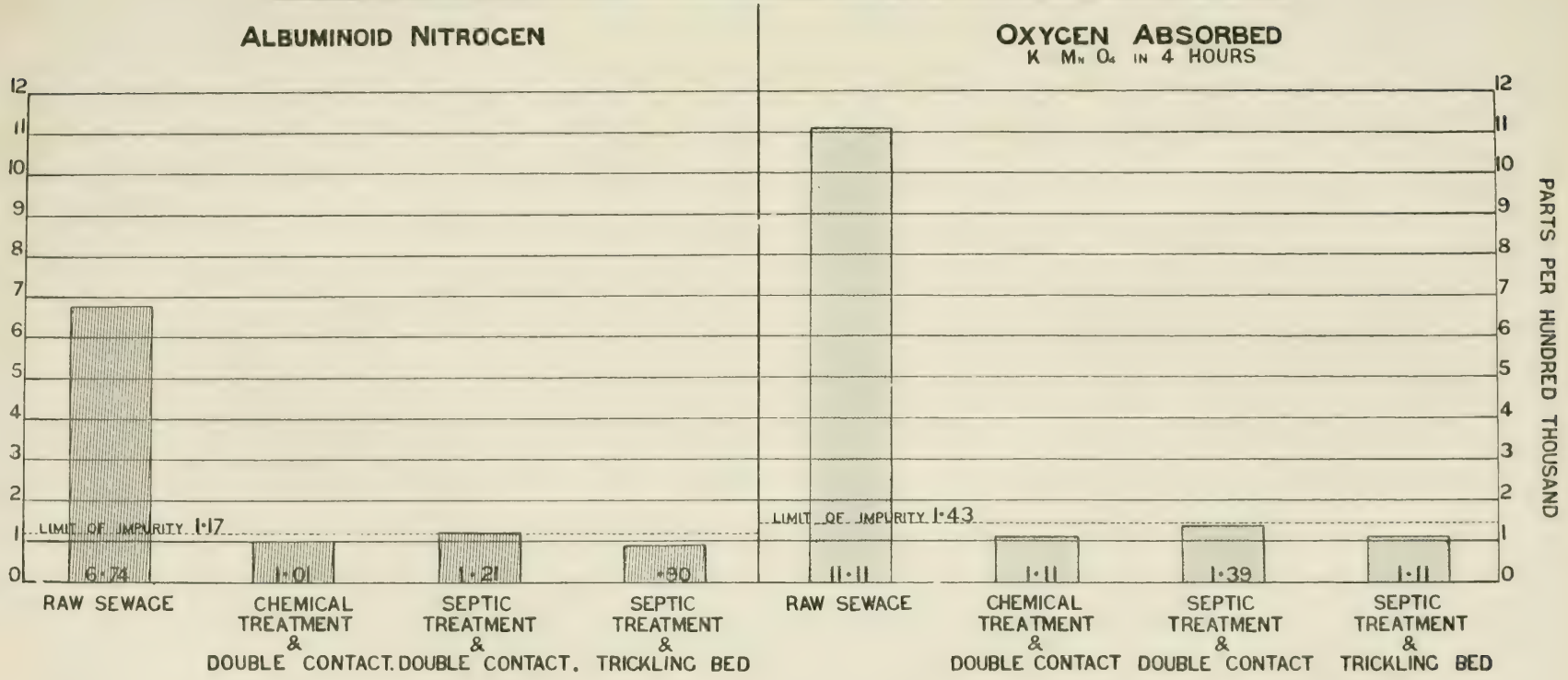
The amount of suspended matter in the septic effluent is excessive, and unless the sludge was to be regularly removed from the exit end of the tank a large amount of it would be carried forward with the effluent, and that which did not settle in the carriers would be deposited on the beds.

From the statements made by various authorities on sewage treatment, it appears that the preliminary anaërobic or septic treatment of some sewages induces a more vigorous action in the beds used for their subsequent purification. This however has not been the author's experience with the Huddersfield sewage. The contact beds treating the chemically precipitated sewage effect a slightly higher percentage purification, and produce a better effluent than those treating the septic effluent.

Taking into consideration the cleanliness of chemical treatment or the sedimentation of sewage under aërobic conditions, the reduced tank accommodation necessary and the slightly improved condition of the effluent for subsequent purification, having regard to its greater freedom from suspended matter and slight free alkalinity, the author is of the opinion that these should not be overlooked in making comparisons with the advantages of the septic process, which are, the saving of the cost of chemicals, the production of less sludge, which however is of a more foul character, and the better mixing of the various strengths of sewage, but which would not be so necessary were the manufacturers to allow the waste to flow into the sewers gradually.

With regard to the form of beds used for the purification of the tank effluent, the contact bed has now a most serious rival in the trickling bed, the almost wonderful amount of purification effected by the latter bed,

PURIFICATION EFFECTED BY VARIOUS METHODS OF TREATMENT



greater than that effected by double contact, and necessitating less than half the area of land, compensating for the extra cost of the material, which must be much coarser than that required for contact beds and is therefore much more difficult to procure. In addition, it has not been found possible to maintain a constant capacity with contact beds, matter slowly but continually accumulating in them, and the author is of the opinion that the life of a trickling bed would be much more permanent than that of contact beds, owing to the irreducible matter coming away with the effluent.

A comparison in diagrammatic form of the results obtained by the three methods of purification accompanies this paper. The darker columns of the diagram represent the amount of albuminoid nitrogen in the raw sewage; the effluent after chemical precipitation and double contact; the effluent after septic treatment and double contact; and the effluent after septic treatment and trickling bed respectively. The lighter columns represent the oxygen absorption from potassium permanganate in four hours in the sewage and effluents.

In the case of the albuminoid nitrogen and the oxygen absorption, the limit of impurity imposed by the Rivers Board is indicated by a horizontal dotted line.

Mr. Douglas Archibald (London) said it would be interesting to know whether the contact beds and open septic tanks remained constant in capacity after a considerable length of time. If Mr. Campbell found they did, he thought it was an exception to the general rule.

Mr. W. T. Burgess (London) asked a question with regard to the materials used in the construction of the trickling beds. He gathered from Mr. Campbell that the only thing used was clinker. Had other materials been tried and found wanting?

Dr. Rideal (London) said he thought Mr. Campbell's paper was a suitable corollary to the discussion of the previous day. Someone had said an ounce of practice was worth a large quantity of theory. Now Mr. Campbell's practice had been to try all different processes, beginning with Mr. Douglas Archibald's, and finishing off with the process which he (the speaker) ventured to put forward as come to stay, namely, septic followed by trickling. Mr. Campbell's series of experiments had shown that all the previous processes did not give such good results as this final method in the aërobic filter in which the ratio of air and water was maintained, and from an economic point of view, from a cost point of view, the result was that the quantity of material and the area required for filters by this last method were both smaller than in any other. The quantity of fat was very interesting. He wished that in other sewage works also the

quantity of fat that passed through the different processes was determined. It was a very simple chemical operation, and should, he thought, be included in the results, because, after all, it was the fat or greasy matter which was the difficult thing to deal with, and accounted for much of the clogging of the contact beds. Mr. Campbell had shown that the raw sewage contained 28·94 parts of fat as against 7·63 parts in the septic tank effluent. The effluent after the double contact only contained 1·9 parts of fat, so that there was a difference of five or six parts of suspended matter in the form of fat which was retained in the contact bed. Now that showed that the sludging up of the contact bed in this particular case was due to fat. When contact beds had been described as sludge-eaters, it was the destruction of organic nitrogenous matter that had been referred to, but no one had ventured to put forward the contact bed as a suitable apparatus or machine for the hydrolysis and decomposition of fat, and Mr. Campbell's chemist had shown that it was not the case that fat could be digested in a double contact bed. That was the reason for the falling off of the capacity.

MR. DOUGLAS ARCHIBALD (London) said that he was afraid he must disclaim the honour of having any special method of his own which was entitled to be designated by his name, but, he would say that his belief was that the success of chemical treatment and contact beds depended entirely on the kind of chemical treatment employed. There were people who talked about chemical treatment and put in four grains to the gallon. Of course, that was one kind of chemical treatment, but he believed in nothing but the best, and it was exactly that point which he tried to put forward the previous day when he said that the chemical treatment cases should be judged by the best and the bacterial by the average. And he maintained his point simply for this reason, that man had charge over the chemicals, and if he chose to put in a large quantity and work it properly, he could always manage to secure the best results, but if he trusted to the action of bacteria, and the bacteria did not choose to do the work properly, that was not his fault, and therefore he had more control over the one than over the other. If that was the case a man who, owing to parsimony, or false economy, put in next to nothing, and then wondered why the chemical system broke down, had only himself to blame. It was for that reason, he thought, that chemical treatment had been so often abused. The system which he advocated, and to which he pinned his faith, was one in which the maximum quantity of materials was used and the sludge was worked up properly and sold as a manure. That was the only way in which the expense of the treatment could be recouped. Any other less complete system was likely to break down, and he did not consider it should be called chemical treatment. How many grains per gallon were used at Huddersfield? He did not know, but he asked them not to attach his name to chemical treatment with double contact, but only that special form of it which was the maximum and the best. He was quite prepared to accept the good points

of any other system as long as he could see them proved. He should like Mr. Campbell, in his reply, to say what was the depth of the trickling bed, because it was a very important point. It was useless to talk about gallons per square yard; he wanted to know what the rate was in gallons per cubic yard. That was the only fair way, because in some cases it was impossible for people to have such a depth of filter as was talked of in a continuous bed. Mr. Campbell said something about 7 feet deep.

Dr. Gilbert Fowler (Manchester) said he wished that all returns could be reduced to what he thought was a very useful expression, that of the "acre-yard"; it would clarify the discussion in many cases. He agreed that where there was not sufficient area to construct beds, the trickling method would enable the engineer to get his work done on smaller area, and this was one case where the trickling method was certainly to be preferred. He understood from the paper that the second contact beds were practically of the same area as the primary beds. He had found in Manchester beyond doubt that, having a first contact bed, the effluent from that first contact bed could be passed over the second contact bed at double the rate of the first, and one got a thoroughly satisfactory result. He asked if this had been tried in Huddersfield, and had not been found possible. Manifestly if it was possible to have only half the acreage for the second contact, that reduced the total required to a figure more nearly approaching that needed for the trickling method. The material used appeared to be rather large, and it seemed to him that if finer material had been used that a greater degree of purification might have been attained. It seemed to him that there was rather a small increase of purification between the first and second contacts.

Mr. K. F. Campbell (Huddersfield), replying to the discussion, intimated that, in his opinion, the original capacity of contact beds in their treatment of the raw sewage of a manufacturing town could not be maintained, and he would venture to suggest to engineers to be careful as to the extent to which they should pin their faith to that novel system on anything like an extensive scale. Undoubtedly the percolating bed was a step in the right direction, and having under somewhat exceptional circumstances given it a fair trial over an extended period the conclusion arrived at is that up to the present time it has no serious rival, the last results being obtained with beds from five to seven feet in depth composed of hard clinker of the sizes given in the tables of his paper. On no account should coke be used as it has a tendency to break up into a fine ash, thereby choking the beds. As to the form of sprinklers best adapted for applying the sewage to the beds, the author is of opinion that there is yet much to learn in that direction, more particularly where space has to be considered. He hoped, in connection with the new scheme designed for Huddersfield, to be able to overcome many of the objections to the sprinklers now used, in which case the members, when the works are completed, would have the benefit of any improvements carried out.

EXPERIMENTS IN SEWAGE TREATMENT AT SHEFFIELD.

By CHARLES F. WIKE, M.Inst.C.E.,

City Surveyor, Sheffield.

THE Sheffield Sewage Works were opened in the year 1886, and were designed entirely for the lime precipitation process, without any provision for land filtration. At the time the system was approved by the Authorities, and it was hoped a solution of the sewage problem had been reached so far as Sheffield was concerned. It is not the object of the author to recount the phases through which the sewage question has passed since the date when the Sheffield works were opened, but very shortly after he first occupied his present office in 1888 the question of more effectual treatment was raised. Various steps were taken to improve and perfect the system of purification for which the works were constructed, and in 1897 experiments in biological treatment were commenced.

Early Experiments.

At first these experiments were on a small scale, some of the existing tanks being utilised. Effluent from the lime process was treated by double contact, the medium being small coal, and raw sewage was also dealt with, both coal and gas coke being used in the filters. Satisfactory results were obtained during the two years over which these first experiments extended, but the beds lost considerably in capacity, owing no doubt to the large amount of detritus which passed to them and accumulated.

Bacterial treatment of raw sewage on large coke beds.

The results were however considered sufficiently good to warrant more extensive experiments, and early in 1899 six large contact beds, covering a total area of 9,500 square yards, were constructed.

The ground, which is of a clayey nature, was excavated to a certain extent, and the material so obtained was used for the banks and divisions between some of the tanks. Three of the new beds were filled with large gas coke to a depth of 5 feet, and three with coke breeze to a depth of $3\frac{1}{3}$ feet, the former acting as first contact beds and the latter as second contact beds.

Raw sewage which, like the rest of the sewage entering the works, had passed through catchpits, was then pumped into the beds without further settlement.

The resulting purification, which has since been carefully observed and recorded by a series of analyses extending up to the present time, is regarded as exceedingly satisfactory. The final effluents have at all times been non-putrefactive, capable of supporting fish life, rich in nitrates, and conforming to the standards employed by the Rivers Board Authorities.

The one serious defect so far discovered is the reduction in capacity, attributed to the silting up of detritus and other solids not intercepted by the catchpits. Specimens of the deposit so formed have been analysed and the result is as follows:—

Organic and volatile matter	44·3 per cent.
Mineral matter	55·6 „

Open Septic Tank Experiments.

On account of this decrease in capacity it was decided to elaborate the experiments by treating sewage from which, by preliminary treatment, the detritus and suspended matter had as far as possible been removed, and accordingly an open septic tank and further double contact beds were installed. By this method raw sewage, after passing a $\frac{1}{2}''$ screen, is passed to a detritus tank $39' \times 4\frac{1}{2}' \times 3'$ deep, and thence into a precipitation tank of 50,000 gallons capacity, which is trapped at each end and acts as an open septic tank.

Sewage has been passed continuously through the tank at a rate of 57,000 gallons per 24 hours, and a portion of the effluent treated on two pairs of double contact beds, one pair being made of clinker and the other pair of burnt ballast.

This process was commenced on June 22nd, 1900, and worked without the removal of any sludge until November 1st, 1901.

The water space having then become much reduced the accumulation of sludge was removed, dried, and weighed. Estimations of the suspended solids entering and leaving the tank had also been made regularly, and,

from the data so supplied, it is calculated that of the solid matter entering the tanks 32·9 per cent. was destroyed.

The tank effluent is usually black in appearance (this being partially attributed to the presence of iron sulphide) and it frequently has an offensive odour. It also contains a considerable quantity of fine suspended matter, averaging 12·45 grains per gallon.

Hydrogen sulphide is usually present in the vicinity of the effluent channel and readily blackens lead plates or lead acetate paper.

The sludge left in the tank is of varying consistency, some having to be removed with shovels. It has an offensive odour, but otherwise is not more difficult to deal with than sludge from the chemical precipitation process.

The purification effected by double contact on effluent from this open septic tank has been good. The final effluents have usually conformed to the commonly accepted standards of purity, but have not attained the high standard of the effluents from the fine coke breeze beds.

Typical analyses selected from a great number regularly made during all the experiments are given on page 520.

Capacity of Contact Beds.

From time to time the capacity of the contact beds receiving the effluent from the open septic tank has been carefully gauged, and the following are some particulars of these gaugings:—

Details of First Contact Bed (Clinker).

Capacity of empty tank	...	8,021 gallons.
Depth of material ...	...	3 feet.
Grade of material ...	...	2″ to ¾″
Number of fillings...	...	3 per day on 6 days per week.

Water capacity of the Bed.		Percentage loss of capacity.	Number of fillings.
Date.	Gallons.		
July 25th, 1900	3,772	.....	5
June 24th, 1901	2,382	36·8	884
September 24th, 1901	2,071	45·1	1,118
June 24th, 1902	2,005	46·8	1,727
December 23rd, 1902	1,980	47·5	2,168
May 26th, 1903	1,728	54·1	2,530

Details of Second Contact Bed (Clinker).

Capacity of empty tank ... 8,900 gallons.
Depth of material ... ... 3 feet.
Grades of material ... $\frac{3}{4}$" to $\frac{1}{4}$".
Number of fillings... ... 3 per day on 6 days per week.

Water capacity of the Bed.		Percentage loss of capacity.	Number of fillings.
Date.	Gallons.		
August 13th, 1900	4,378	.....	5
June 24th, 1901	3,687	15·7	838
September 24th, 1901	3,557	18·7	1,072
December 24th, 1901	3,233	26·1	1,229
June 24th, 1902	3,527	19·4	1,657
December 23rd, 1902	3,317	24·2	2,098
May 26th, 1903	3,259	25·5	2,460

The material in the bed was turned over on March 12th, 1902, when the capacity was increased in consequence.

Finely divided solid matter is found to be deposited on the material of the first contact beds, and a slow decrease in capacity is taking place; a result which can only be expected in cases where the liquids dealt with contain suspended solids, some portions of which are composed of mineral matter.

The second contact beds on being dug over, considerably improve in capacity, and it therefore appears that much of the diminution observed, after the initial loss, is due to settlement of the material forming the bed.

Treatment of Settled Sewage by Double Contact Beds.

Having in view (1) the good results obtained by the treatment on coke beds of crude sewage, which has not passed into a septic condition, (2) the large area of tanks required for the open septic process, (3) the comparatively large quantity of suspended solids in the open septic tank effluent, and (4) the danger of nuisance from these tanks which at times is very apparent, it was decided to further experiment with sewage which had been allowed quiescent settlement in a tank, drawing off the supernatant liquid by means of a floating outlet, and dealing with the sludge separately as in the case of a precipitation process.

A precipitation tank similar in every respect to the open septic tank was accordingly set apart for this purpose, and supplied with sewage from the same delivery pipe and catchpit.

A first contact bed of clinker was constructed to receive the effluent from this tank, and in addition a small experimental filter has been used for second contact in order to observe purification results.

A portion of the material forming the first contact bed is graded, the smaller material being at the surface in order if possible to retain the suspended solids, and prevent the silting up of the bed generally.

Details of the method of working and capacity of the bed are as follows:—

DETAILS OF CONTACT BED (CLINKER).

Area of Bed	... 221·3 square yards.
Average depth of material	... 33 inches.
Grade of clinker	... $1\frac{1}{2}''$ to $\frac{3}{4}''$ with a 9″ layer of 3″ to $\frac{1}{4}''$ and 3″ of $\frac{1}{4}''$ to $\frac{1}{8}''$ extending over half the area of the bed.
Number of fillings	... 3 per day on 6 days per week.

Water capacity of the Bed.		Percentage loss of capacity.	Number of fillings.
Date.	Gallons.		
August 9th, 1901	16,070	.....	5
August 8th, 1902	9,830	38·8	842
December 28th, 1902.....	9,924	38·2	1,157
May 15th, 1903	9,167	42·9	1,517

The sewage, after settlement for two to three hours in the precipitation tank, has been allowed to flow upon the first contact bed, which is worked in a similar manner to the beds treating open septic tank effluent, and the sludge has been removed after every twelve fillings.

The tank effluent has contained an average of 7·53 grains of suspended matter per gallon. The purification obtained has been very satisfactory, the effluent from the first contact bed having frequently conformed to the commonly accepted standard for oxygen absorption and albuminoid ammonia, and it has usually contained nitrates.

The second contact effluent has been uniformly excellent, containing nitrates in considerable amounts, and remaining perfectly sound on incubation.

The following are typical analyses from a long series made during the

experiments, both with the open septic tank and with what may be termed the sedimentation tanks:—

Results expressed in parts per 100,000.

Oxygen absorbed in four hours.				Albuminoid Ammonia.				Nitrogen as Nitrates.	
Sewage.	Septic Tank Effluent.	1st Contact Effluent.	2nd Contact Effluent.	Sewage.	Septic Tank Effluent.	1st Contact Effluent.	2nd Contact Effluent.	1st Contact Effluent.	2nd Contact Effluent.
7·85	5·87	2·68	1·01	1·34	·88	·40	·128	—	·30
6·23	4·28	1·68	·73	1·11	·70	·28	·114	—	·48
5·64	4·90	1·71	1·07	·85	·57	·23	·114	—	·70
Sewage.	Settled Sewage.	1st Contact Effluent.	2nd Contact Effluent.	Sewage.	Settled Sewage.	1st Contact Effluent.	2nd Contact Effluent.	1st Contact Effluent.	2nd Contact Effluent.
7·93	4·90	1·80	·75	·94	·51	·17	·071	·17	1·57
6·63	3·71	1·47	·58	·80	·46	·17	·085	—	1·27
5·87	4·43	1·86	·63	·91	·64	·18	·071	·40	1·80

General Conclusions.

Up to the present the results obtained from the experiments described indicate that the sewage of Sheffield can be purified satisfactorily by the simple settlement of the sewage in tanks, and by subsequent treatment in double contact beds. In the case of settled sewage, greater purification has been obtained than by the open septic tank process, although both systems have given effluents which are non-putrescible and conform to any reasonable standard of purity for sewage effluents.

The great advantage which it was anticipated would result from the action of the open septic tank in facilitating further purification has not been realised, nor apparently does the system present a solution of the sludge difficulty.

As the proportion of sludge destroyed is only about 30 per cent. and probably less, it is a question for serious consideration whether in consideration of the large tank area required, the liability to nuisance, and the difficulty in dealing with sludge in bulk, are compensated for by the destruction of so small an amount of sludge.

It is possible that, in dealing with some classes of sewage, superior purification is obtained after such a treatment; but this has not been the experience of the writer in treating over a million gallons per day during the past four years of raw sewage on contact beds. Probably the question

is one which each authority must settle for itself, bearing in mind its own particular conditions and the varying trade wastes, etc., which occur and complicate the problem.

Albuminoid matter is certainly broken down by the action of the open septic tank, but the rate of the process is not known, and in the case of Sheffield it is not considered that the necessity of reducing sewage to the offensively putrefactive stage in order to effect efficient oxidation has yet been demonstrated.

In this paper no attempt has been made to describe the whole of the Sheffield experiments, but only to compare the results of treatment of effluent from the open septic tank, and from the sedimentation tank.

The author hopes shortly to enter more fully into the general question.

The foregoing tables have been prepared with the assistance of Mr. John Haworth, chemist at the sewage works, who has been engaged upon the experiments described.

CHINESE HYGIENE.

By ARTHUR STANLEY, M.D., B.S.Lond., D.P.H.

Health Officer of Shanghai.

IF prolonged national life is indicative of sound sanitation, the Chinese are a race worthy of study by all who concern themselves with public health. Even without the returns of a registrar-general it is evident that the birth-rate in China must very considerably exceed the death-rate, and has done so in an average way during the three or four thousand years that the Chinese nation has existed.

Chinese hygiene is the product of an evolution extending more than two thousand years before the Christian era. There are no Chinese sanitary laws like those of the Mosaic code, but the Taoist religion is largely based on health maxims, though lost amongst a mass of superstitious absurdities and spirit lore. In the Su-wen, a book which is 2,000 years old, the philosophy of the body and of health is fully developed in the old Chinese way. It defines sanitation as health preservation so as to live to old age. It holds that true sanitation is in conformity with nature's laws. Every one who attends to these can live to be a hundred years old. The Chinese know that in order to live long they must live moderately, and they have two main laws of health which are very comprehensive, namely:

(1) Restraint of all the appetites.

(2) Cleanliness in house and person.

Regarding the attitude of the Chinese to modern public health measures it may be noted that their prejudices are strong. The Chinese are a people with a supporting belief in all kinds of drugs, charms, and spells, while their medical methods are empirical and founded mostly on the fancies of the alchemistical religion of Tao. The Chinese drug-shops contain an immense number of drugs and preparations, and are the most elaborately ornamented of all shops; the Chinaman spending a large part of his income on medicines. It is not surprising, therefore, that modern public health measures, which are founded on organised common sense and from which the personal factor of the relation between doctor and patient,

with all its fallacies, is eliminated, do not appeal acutely to the Chinaman. He is attracted by the merest scum only of so-called western civilization, furnished by well-advertised patent medicines and itinerant quacks in the sacred name of trade. As in diseases the least curable, there are the greater number of drugs recommended for their cure, so it is with the Chinese who, though ignorant of the real cause of disease, have a proportionately great desire for a multitude of drugs—the Chinese pharmacopœia is the largest in the world. In China, therefore, considerable breadth of view and treatment is necessary in hygienic measures. With an unsympathetic people like the Chinese, sweeping sanitary measures are difficult of operation, and though hygienic conversion is hard, dragooning is still less effective, and any attempt to hustle the east is poorly rewarded. The processes of social evolution can perhaps be studied on broader lines in China than anywhere, on account of its particularly massive and concrete historical records; and the lesson appears to be that in many respects the methods of some centuries of practical experience are frequently confirmed as good by modern science. And it is by following out these methods in a spirit of scientific sympathy, tempered by an accurate appreciation of Asiatic environment, that the best results may be attained.

FOOD.

On seeing the Chinese housewife washing rice in the nearest puddle, most foreigners exclaim, "What beasts these be!" The observing man, however, discovers that rice is not washed to make it clean, but to free it from the fine particles of starchy matter, which, if left, would cause the rice to boil to a glue-like mass. It is the subsequent boiling that effectually protects the consumer from any disease that might have arisen from washing it in evil waters. The Chinaman eats and drinks little that has not been subjected to the temperature of boiling water or boiling oil, and is therefore largely preserved from typhoid fever, cholera, and other diseases which are caused by infected food. There is no food infection known which will survive the temperature of boiling water.

The Chinaman is not a great fruit eater. He is such an excellent cook that he prefers foods in which nature has been improved by art. He abhors raw things as a rule. Raw oysters, for example, the Chinese will not eat, considering them "too cold for the stomach." Except under great stress, he drinks no cold water, but always tea made with boiled water, and thus avoids water-borne disease. Regarding disease infection therefore, the principles which govern the Chinese dietary are true ones.

Concerning the quality of Chinese food, a European would generally

say there is no "stamina" in it. Diseases, however, like rickets and gout, which are attributed to disordered metabolism, are conspicuous by their absence among the Chinese. Functional disease of the stomach and alimentary tract is less common than among Europeans, and the teeth of the Chinese are admitted by all to be exceptionally beautiful and good. Look at the clean-limbed, muscular Chinaman of the fields! He is the picture of health and agile strength as he sings through the hottest or coldest day's work. Singing at work, which is practically universal through China, indicates a vital energy in excess of that required for the labour in hand. The weary worker has no song. A Chinaman planting rice-shoots on a summer day, with his bare legs in the mud, sings a pæan of nature exuberant.

Regarding food, therefore, modern hygiene has little to teach the Chinese while he abides by the principle of eating and drinking nothing that has not been thoroughly cooked. He is apt, however, in a foreign environment to consume aerated waters and other unusual things, and suffers thereby.

Houses.

In a Chinese house the weight is carried on wooden posts; the framework and roof being first erected, and the walls filled in afterwards. There are usually plenty of windows and other openings, and in the case of shops the front is entirely open, so that the workmen are practically all the day in the open air. The houses are closely aggregated and the streets as narrow as possible, a condition which tends to cosiness and warmth in winter by keeping out the wind, and coolness in the summer by keeping out the sun. This, with their peculiarly warm and at the same time light clothing is possibly the reason that catarrhs, bronchitis, and rheumatisms, which may be attributed to cold, are less common among the Chinese than among Europeans. The Chinese dwelling has plenty of natural ventilation. With regard to sleeping accommodation the Chinese closely resemble most of the rest of the animal creation in getting into a small, close, warm place for sleep. It is probable, however, that impure warm air is less injurious than cold pure air during sleep. And during sleep less air is required than at other times, while the body is more subject to chills. Although bad smells abound near Chinese houses, smell is not a perfect test of unhealthy environment. There is little sewage from a Chinese house, for all excreta are treasured up in water-tight vessels, in which fermentation is allowed to take place, producing manure for the garden and field.

The houses of the Chinese working-classes are, therefore, probably healthier than those of the European working-classes. Modern hygiene would require the proper paving of the site and immediate surroundings of the Chinese house, the provision of a curtilage to each house, and greater width of streets. The greatest sanitary evil in China is undoubtedly overcrowding, everywhere admitted to be the worst of all unhealthy conditions, and one that cannot be counterbalanced by other sanitary measures. It is here that modern sanitation is diametrically opposed to the Chinese method of closely herding together, which is the result of an evolution, influenced by a feudal environment, in which the people collected together, mostly within walls, for the purpose of mutual defence against outside marauders.

DISPOSAL OF REFUSE.

It is in the disposal of refuse that modern hygiene has the least to teach and the most to learn from the Chinaman. The principle of returning ordure and garbage to the soil is the only true and economical one. By this means alone can the energy residing in the soil be conserved. The water carriage of sewage and its most modern treatment in mass by bacteriological methods is a crude imperfection when compared with the Chinese method of returning all refuse to mother earth, which it replenishes and is at the same time purified by the most complete bacteriological processes. The upper layer of the soil is the universal purifier; it is here that the nitrifying and other organisms reside which convert organic refuse into inorganic plant food. Before applying ordure to the soil the Chinaman as a rule allows it to undergo ammoniacal fermentation in pits and kongs. In this process the complex nitrogenous bodies are broken down into simpler ammonia salts, which is a stage nearer to the formation of nitrates by the nitrifying organisms; the latter being the only compounds of nitrogen which are assimilable by plants. These ordure pits and urine kongs are a characteristic feature of the Chinese landscape and give rise to the *bouquet de chine*, which is one of the many sacrifices the Chinaman makes at the altar of agriculture. But besides improving the manurial value, these fermenting pits to a large extent kill any pathogenic organisms that may be present. The fields of China sufficiently demonstrate the great manurial value of human excrement, producing fruit, flowers, and vegetables in the highest perfection.

The main problem of sanitation is to cleanse the dwelling day by day, and if this can be done at a profit so much the better. The Chinese solved the question of economic sanitation long ago. While the ultra-

civilized European elaborates destructors for burning garbage at a financial loss and turns sewage into the sea, and also frequently into the water he drinks, the Chinaman converts each into a source of profit by using them for manure. He wastes nothing while the sacred duty of agriculture is uppermost in his mind. And in reality recent bacteriological work has shown that fæcal matter and house refuse are best destroyed by returning them to clean soil where natural purification takes place. On the other hand, the typhoid bacillus, and, to a less extent, the cholera bacillus can live and even multiply in polluted soil, that is, in soil holding a larger quantity of organic matter than it can elaborate into plant food; while both cholera and typhoid fever can infect vegetables if infected ordure is directly applied to them. In China these two diseases are less frequently water-borne than derived from infected vegetable food. And in this connection it may be noted that typhoid fever is much more common among Europeans resident in China than among those in the home lands. This greater prevalence of typhoid fever in China would appear at first sight a strong argument against the principle of returning refuse to the soil, but it is more probable that the fault lies with imperfect details. The native doctor does not disinfect the stools of typhoid fever cases.

Inasmuch as ordure is disposed of by natural principles, there is little real sewage in China, so that there is no need for a costly and elaborate system of drainage. The numerous waterways and the aggregation of the non-agricultural population near them render artificial sewers to a great extent unnecessary. In the great cities near the mouth of rivers and on the deltas the numerous tide-flushed creeks perform the function of the sewer. These willow-grown creeks, which form so pleasing a feature of the landscape of the Yangtza Delta, when kept clear and deep, so as to be flushed twice daily by the most economical and effective of all flushing apparatus, the tide, are excellent sewers and save much expense of artificial drainage. If maintained clean and clear the creek is a perfectly legitimate and sanitary method of drainage, especially where there is little excremental sewage. And in the construction of these creeks the Chinese are masters of the art of irrigation. The motto of Li Ping the great Szechuan engineer, inscribed twenty-one centuries ago in the temples among the hills above the Cheng-tu plains, "Dig deep the bed, keep the banks low," is as applicable to the whole of China as it was to the great irrigation works of the Cheng-tu plain.

It is in the construction of house drains and street sewers in the cities that modern hygiene can be of use. Down the centre of many streets in Chinese cities runs a trough of brick or mud covered with flag-stones.

Through the many places where the covering is imperfect can be seen a black fermenting mass, whose only chance of removal is afforded by a heavy fall of rain. The street sewers discharge into ditches, which become the most noisome of septic tanks through blocking with garbage. In the cities, also, where agriculture is not the chief occupation of the inhabitants, garbage is allowed to accumulate. When divorced from agriculture, the principle of returning all refuse to mother earth does not flourish so happily. Self-interest is the mainspring of good works, and in the cities it does not always pay to remove garbage to the agricultural districts; ordure, however, always commands a good price and a ready sale, and its exploitation in most Chinese cities is a lucrative business.

PREVENTION OF INFECTIOUS DISEASE.

The prevention of infectious disease is the chief function of modern hygiene. Notwithstanding the great mass of recent pathological research, which has been the only real advance that medicine has made since the days of Hippocrates, Jennerian vaccination remains the type of all that is best in preventive medicine. The Chinese, however, anticipated Jenner, for they inoculated with small-pox as a protection against severe small-pox when our ancestors were painting themselves with woad. The Chinese were intellectual giants by comparison in those days. The Chinese have seen most of the great nations of antiquity in and out, and still remain a great people. Why has not China gone the way of the rest? The methods of living of the people must be essentially good.

The Chinese do not practise isolation of infectious disease. They have, however, been known to evacuate villages stricken with plague, and they frequently burn the clothing and bedding of persons dead of small-pox and cholera. The methods of modern hygiene, born of the true knowledge of the cause of infectious disease—notification, isolation, and disinfection—will come into play when the Chinese medical man ceases to be a mere drug-vendor and is received into the lap of science. This will take a long time. The Chinese are platonic rather than aristotelian in their methods of reasoning, deductive rather than inductive, and have not that aspect of mentality which assimilates the natural sciences readily.

DISPOSAL OF THE DEAD.

The Chinese method of burial compares to advantage with that of Europe. In China the burial rites assume much importance. The coffin is of very thick wood, mortised together and varnished, so as to be practically air and water tight. Prior to placing the body in it the coffin is

half-filled with lime. The coffin is rarely buried at once, but awaits prolonged funeral rites in the mortuary chapel, or in the residence of the deceased. In the mortuaries the coffins can be seen in rows of hundreds, and the freedom from disagreeable odour indicates the goodness of the coffining. The coffins are finally buried under a mound of earth, or in a brick tomb, above the level of the surrounding land. These are scattered through the landscape and, surrounded as they frequently are by trees and shrubs, usually form a pleasing feature.

The absence of cremation among the Chinese is notable, considering its popularity in other Buddhist countries, such as India and Japan.

Clothing.

The materials used for clothing by the Chinese are mainly cotton and silk. In hot weather the men do not wear hats and the workers little more than cotton drawers. The dress of Chinese women is perhaps the most modest in the world, the lines of the figure are rarely shown, though a well dressed Chinese woman is a model of neatness. In the cold weather they increase the number of garments and wear an outer garment padded thickly with cotton wool, which is very warm and at the same time light. The children appear twice the size in winter and rarely suffer from cold. The cold weather clothing is considerably lighter, warmer, and cheaper than European clothing, and enables them to a large extent to do without artificial heat. Chinese clothing is more hygienic than that of Europeans, excepting the shoes of the women with small feet.

Habits.

In Europe alcoholism is the greatest obstacle to sanitary reform, and the death-rate is more increased by this and its attendant misery in the course of one year than in ten by all the infectious diseases. Drunkenness is practically non-existent in China. Opium smoking is perhaps the equivalent in China of alcoholism: the sedative effects of opium being more in keeping with the Chinese character than the temporary mental and muscular excitement produced by alcohol, which is desired by Europeans. But in comparison with alcohol, the evil wrought by opium is trivial. The opium habit is perhaps more nearly equivalent to tea-drinking or tobacco-smoking. While alcohol causes disease of most of the organs of the body and is one of the chief causes of insanity, opium produces scarcely any changes that can be recognized post mortem.

The polygamous marriage system of China is good in so far as unmarried females are rendered few and consequently prostitution with its evil train

of disease comparatively rare. Concubinage under a strict system must be admitted to be preferable to the flaunting prostitution of Europe.

CONCLUSIONS.

Though the Chinaman is sometimes spoken of as the most unsanitary of individuals, he would be a poor observer who would hold that Chinese sanitation is not better than that of mediæval Europe. Were China imbued with the true scientific spirit she would become perhaps a model of sanitation, because the methods of living of the people are essentially good. The prolonged national life of the Chinese and their great population is an unanswerable argument indicating sound sanitation; pestilence rather than war being the cause of the disappearance of the nations of antiquity, whose origin was synchronous with the Chinese. At the present day the thrifty millions of China overflow their own country and compete so successfully with the British and Americans that laws have been made in America and Australia forbidding the immigration of Chinese.

From a hygienic aspect many of the modes of living of the Chinese are better than those of modern Europe; for example, in the matter of food, disposal of refuse for the benefit of agriculture, clothing, and in the comparative absence of alcoholism and prostitution.

The two ancient Chinese sanitary principles, restraint of the appetites and cleanliness in house and person, are the shortest and most comprehensive summary possible of modern public health rules, including as they do most of what is esssential in modern hygiene.

Antiquity in national life is good because it allows evolution to have full development. In social etiquette, for example, ceremonials have been gradually perfected through long periods of time, so that their modes of social intercourse are the most punctilious and refined. In general life it is admitted, by those who have frequent intercourse, that the Chinese gentleman is the most polite in the world. In a somewhat similar manner it is conceivable that the modes of living for the promotion of health have undergone evolution.

OBITUARY.

WILLIAM HENRY CORFIELD, M.A., M.D.Oxon., F.R.C.P.Lond., F.G.S., F.C.S., F.I.C., Hon. A.R.I.B.A.

Vice-President and Treasurer.

It is only right that some tribute to the memory of Professor W. H. Corfield, M.D., should appear in the Journal of The Sanitary Institute, as its Council, Fellows, Members, and Associates must feel the loss of his services which have been so great and so cheerfully rendered from the year 1876 onwards as the Vice-President, Chairman, and, for the last three years, as Treasurer of The Sanitary Institute and Parkes Museum.

He was President of the Conferences of Medical Officers of Health held in connection with the Congresses of the Institute at Bolton and Worcester, President of Section I. at the Newcastle Congress, and President of the meeting held by the Institute in Paris in 1900. Dr. Corfield was Chairman of the English Committee of the International Congress of Hygiene and Demography.

The *Times* newspaper in announcing Professor Corfield's death at Marstrand, Sweden, on the 26th August, 1903, gives a correct summary of his career from birth, 1843, through Oxford, University College, London, and Medical Schools of Paris and Lyons with many distinctions and honours in a busy life of municipal and public sanitary work as Medical Officer of Health for St. George's, Hanover Square, Consulting Sanitary Adviser to H.M. Office of Works, Hon. Sanitary Adviser to University College and Hospital, &c., &c.

He was appointed Professor of Hygiene in University College in 1869, his chair being the first of the kind established in London. He also initiated in 1875 the first hygienic laboratory.

He was active in promoting the foundation and developing the organization of the Parkes Museum, and took a prominent part in organizing the International Congress of Hygiene and Demography held in London in 1891.

In 1874 Prof. Corfield read a paper before the Epidemiological Society on "The Alleged Spontaneous Production of the Poison of Enteric Fever," in which he vigorously combated the then prevailing views of Murchison as to the possibility of the *de novo* origin of the disease. His conclusions were summed up as follows: "I therefore maintain that foul air contaminated by decomposing animal matters is capable of producing mere diarrhœa, and that when it produces enteric fever it contains the poison of

that disease, and that the arguments adduced to prove that this poison can be generated from such decomposing matters independently of a previous case of the disease are inadequate to do so; that in many of the cases where non-importation is supposed to have been all but proved it has not been even rendered a fair presumption, and, therefore, that in the present state of our knowledge we are not justified in saying that the disease ever arises *de novo*."

One of his most interesting brochures is a pamphlet on "Sanitary Fallacies," which was the substance of an address delivered at Croydon in 1879 to The Sanitary Institute Congress, wherein he sketches the history of the progress of medicine, and dwells specially upon the current fallacies of the day, naming the untenable arguments adduced in favour of the spontaneous origin of zymotic disease, the misunderstanding of the water-carriage system for the removal of sewage, and the popular errors in regard to dietetics and vaccination.

In 1885 he delivered the anniversary address to The Sanitary Institute on the Water-supply of Ancient Roman Cities, with especial reference to Lugdunum (Lyons), in which he showed how the Romans employed inverted siphons made of lead for the purpose of carrying their aqueducts across deep valleys, illustrated by lithographs from sketches made by himself on the spot. In 1893 he delivered his Harveian Lectures before the Harveian Society of London on "Disease and Defective House Sanitation." These lectures have been translated into French and published in the Bulletin of the Royal Society of Public Health of Belgium (1899), and also into Hungarian under the auspices of the Royal Society of Public Health of Hungary.

The Society of Medical Officers of Health will bear its testimony to the tact and efficiency of its past Chairman in the administration of the Public Health Act, 1875, and his Milroy Lectures, 1902, on "The Etiology of Typhoid Fever" must be duly appreciated by medical men as a logical statement of most patient reading and practical investigation up to date.

But members of the Institute are perhaps more generally concerned with Professor Corfield's cordial support of our late colleague Rogers Field in the Reformation of House Drainage and Plumbing which began about 1870.

Energetic as were the Civil Engineers, Rawlinson and Rogers Field, in demonstrating the evils of D-trap, cesspool and direct connection of waste pipes with foul drains, commonly found in dwellings of all classes from palace to cottage of former times, they might not have been able to move public opinion for the adoption of necessary, but expensive, remedies and to secure the education of those who had to carry out the work without the

aid of a scholarly medical scientist of Doctor Corfield's weight and influence.

That assistance fortunately was always ready at hand to press on the reform until the true principles of house drainage have become universally recognised, taught at the Parkes Museum, and generally observed at the present time.

The last occasion on which he came to the Institute was on Dec. 10th, 1902, to preside at a discussion on the Testing of House Drains.

Dr. Corfield as Chairman of the Sunday Society appealed to the public for many years with some success in a matter less directly connected with sanitation; but sewage disposal was the subject of his study early in life when the British Association enjoyed his services as member of their Committee for the purpose, and published "A Digest of facts relating to the Treatment and Utilization of Sewage."

The conclusions thus summarized, viz :—

1. The results of sewage farming properly carried out may be a positive advantage to the Public Health from the luxuriant healthy vegetation supported on the land and the giving off of ozone consequent thereon.
2. There is no proof whatever that entozoic disease has ever been spread by the use of sewage-grown vegetables.
3. Wherever land is available the natural treatment of sewage should be adopted in preference to any other.

have been supported by the Reports of Royal Commissions since 1870, a matter which must have been very satisfactory to Dr. Corfield.

In that sense we may perhaps feel that we are performing an act of piety toward our late colleague in concluding this notice of his life's work with the following extract from *The Lancet* of 7th March, 1903, publishing a letter written within a few months of his death.

To the Editors of THE LANCET.

"SIRS

It is interesting to one who, from the first, condemned the method of disposal of the sewage of London (which was adopted by the Metropolitan Board of Works in defiance of the recommendations of the Royal Commission on Sewage Discharge and has been continued since) to find that the Conservators of the Rivers Thames and Medway, and also a joint committee of the Port of London Sanitary Authority and Sanitary Committee of the City Corporation have adopted a resolution stated in the Times of February 26th."

* * * * * * * *

"In my presidential address to the Society of Medical Officers of Health in October, 1888, after stating the recommendations of the Royal Commission and pointing out that the Metropolitan Board of Works and its advisers were flouting them, I concluded as follows, 'I protest in the name of the Society of Medical Officers of Health of this

country against such a state of things and against the further carrying out of a scheme which, while being enormously costly, will not only not settle the question, but will rather increase the difficulties of settling it effectually and will be pointed out by succeeding generations as a disgrace to the sanitary work of the nineteenth century.'

* * * * * * * *

"And before the Institution of Civil Engineers in February, 1897, I stated that I could not help thinking that if the money which had been spent in trying to purify the sewage of London by means of precipitation and filtration had been spent in taking it out further, as had been proposed, to the Maplin Sands, or some other suitable place, and disposing of it by irrigation, that money would have been very much better spent, and I thought that would be resorted to in the end, however much money might be spent on experiments."

* * * * * * *

I am, Sirs, yours faithfully,

W. H. Corfield, M.A., M.D.Oxon., F.R.C.P.Lond.

Consulting Sanitary Adviser to His Majesty's Office of Works.

Savile Row, W.

March 2nd, 1903.

The above extract affords an example of the forcible style in which Dr. Corfield frequently appealed through the Press to the Public in favour of Sunday opening of museums, libraries, etc., etc., and of sanitary reform.

His letters evoked but little adverse criticism because his facts were stubborn and their exposition clear.

To Prof. Corfield Sanitary Science and our Institute owe a deep debt of gratitude for the valuable services he has rendered to both, and for the brilliant example he has set throughout his valuable and also too short life of applying scientific knowledge to the welfare of mankind. Dr. Corfield is among the pioneers of Hygienic Science and his name will long be revered by many who admired his noble personal character and respected his scientific attainments. A. S. J.

The following note of personal appreciation has been received from a member of Council who was frequently associated with Prof. Corfield in his work :—

"It was one of Dr. Corfield's notable characteristics that he was able with great promptitude to sift out of any matter laid before him the important issues from those which were only of secondary interest. He had an acutely logical mind, and his deductions from the premises before him were nearly always acute and sound. It was this faculty which secured so much respect for his opinion, not only on professional matters but in the ordinary circumstances of every-day life, and which made his services to The Sanitary Institute, while serving on its Council and as Chairman of its Council, of more than ordinary value. Corfield had in

an eminent degree those business faculties which go to the making of a distinguished career in the commercial and many other walks of life, and his abilities were always placed freely at the disposal of those Institutions with which he was associated.

Not less admirable were his powers of concentration and capacity for detail. It was always his great aim to be exact; and his writings, his addresses, and his lectures were characterised by a precision of statement, a clearness of style, and an absence of anything in the nature of "padding," which rendered his literary productions of so much value to the student, and caused his speeches to be so highly appreciated by his audiences. He always made a point of verifying his references, and no trouble was spared in the effort to place before his readers or hearers that upon which they might absolutely rely as being correct, so far as human knowledge permitted.

Much of the pioneer work in any new science—and for the practical purposes of modern life Hygiene may be regarded as a new science, and Corfield was undoubtedly a pioneer in some of its branches—is liable to be marred by statements which, accepted as correct at the time, have had their accuracy seriously impugned by later and more enlightened research. On a review of Corfield's work it may be said that it is notably free from this sort of blemish. He was always more content in the recording of facts than in the propounding of theories on insufficient foundations; and in consequence his teaching did not lead into by-paths where the right direction along the road of science so often becomes hopelessly involved and finally lost. He was essentially a teacher and a guide in first principles; his common sense and his scientific training and acumen were his guides and his justification; and the result is that his work has been eminently useful, and much of it is of enduring value.

Dr. Corfield was not perhaps, a deep thinker, in the sense that he ever made a profound study of the abstruse sociological problems connected with Public Health. It is not often that the intellect which takes a delight in deep philosophical reasoning is combined with a mental attitude that recognises the importance of detail and a mental capacity for its practical application. The latter was Corfield's strong point. He was essentially a practical sanitarian, with little of the philosophic dreamer in his composition. It was the same in the studies of his leisure time. What always interested him was the practical application of the laws of science, whether in the present or in the past. Roman aqueducts, ancient systems of sewerage, and the most primitive forms of privy or water-closet, were infinitely more seductive studies to him than etiological speculations and theories. His researches into ancient sanitary methods have been published in various periodicals. They are most interesting and fascinating studies, and exhibit the best qualities of the author in the subject of his predilection. The Council of The Sanitary Institute might very well consider the possibility of republishing these valuable brochures in a small volume as a tribute to the memory of one of its founders. Their reperusal would undoubtedly give much pleasure to the late Dr. Corfield's friends, associates, and former pupils.

In his private life and amongst his friends and colleagues Corfield

invariably exhibited that amiability of temper which is the essence of good fellowship. He was a most interesting and entertaining companion, combining a wide knowledge of the world with a spirit of tolerance for the opinions of those who differed from him, and a frank and pleasant manner. He was always accessible and ready to give his advice and assistance, and he never set himself up on a pinnacle. To this he owed much of his popularity.

Dr. Corfield had been very much out of health for at least two years before his death. His malady was at times of a very painful nature, but he always maintained his cheeriness and hopeful anticipations, and he showed but few signs of that depression which is so generally the accompaniment of a mortal illness. The Sanitary Institute, perhaps more than any other Society with which Dr. Corfield was connected, has reason to deplore the death of one of its founders and most consistent upholders.

L. C. P.

A Portrait of Dr. Corfield by Lafayette forms a frontispiece to this Volume.

EDMOND ISIDORE ETIENNE NOCARD.

We have to record with sincere regret the death of Prof. Nocard who was present at the Congress of the Institute in Manchester as an official delegate from the French Government, and took an active part in the discussions at the Meeting. We quote the following notes on his life and work from a discourse by M. Ménard, who was the delegate from the French Government to the Bradford Congress.

"Né le 29 janvier 1850, dans une honorable famille de Provins, Edmond Nocard passe les années de son enfance au collège de la ville, puis il entre dans une étude de notaire pour attendre, en perfectionnant son instruction, l'âge d'entrer à l'Ecole vétérinaire, suivant le vœu de ses parents et suivant ses tendances personnelles. Admis à Alfort à 18 ans, il se montre si bien doué et si laborieux que ses camarades ne songent pas à lui disputer la première place. Engagé volontaire en 1870, dans un régiment de lanciers, il se trouve retardé d'une année et il obtient en 1873 le 1er diplôme de sa promotion. Un vétérinaire aussi bien préparé ne pouvait manquer d'entrer dans la carrière de l'enseignement ; il passe immédiatement des bancs des élèves à la chaire du maitre. Les circonstances lui sont d'ailleurs favorables, et de brillants concours le font nommer successivement répétiteur et professeur de pathologie et clinique chirurgicales. Puis il occupe, en 1878, la chaire des maladies contagieuses, à laquelle il donne tant d'éclat et tant d'importance, non seulement par son enseignement et par ses travaux scientifiques, mais encore par les

applications multiples à la police sanitaire qu'il a instituées ou suivies, au grand profit de l'agriculture, de la fortune publique et de la santé publique.

"La caractéristique des travaux de Nocard, c'est celle de l'École Pastorienne: recherches de haute science biologique comme point de départ des applications pratiques les plus utiles, avec toutes leurs conséquences économiques. Il est impossible de les énumérer tous ici; je citerai seulement ses études sur les mammites de la brebis et de la vache, le farcin du bœuf, la rage, le tétanos, les piroplatmoses et les maladies à trypanosomes, les infections ombilicales des veaux, l'avortement épizootique, la péripneumonie, la morve, la tuberculose, la peste du cheval, la clavelée, la fièvre aphteuse. Tous les détails en sont exposés dans un ouvrage magistral, "*Les Maladies microbiennes des animaux*," écrit en collaboration avec son élève Leclainche. Ce livre a déjà une troisième édition; il a valu à ses auteurs un des prix Montyon de l'Institut.

"Mais l'œuvre capitale à laquelle s'est voué Nocard, à laquelle il s'est épuisé, cela a été la vulgarisation des mesures de prophylaxie de la morve et de la tuberculose, les deux maladies qui déciment le plus de bétail et menacent la santé humaine. Le diagnostic précoce de la morve par les épreuves de la malléine, de la tuberculose par les épreuves de la tuberculine permet d'isoler ou de supprimer les animaux contagieux. Il fallait l'apprendre aux intéressés. Non content de l'écrire et de le redire à Paris, notre confrère n'a pas craint d'aller lui-même porter la bonne parole en tous points, de faire des conférences aux vétérinaires, aux agriculteurs, aux éleveurs, de multiplier des essais et des démonstrations expérimentales. Il y a dépensé le meilleur de lui-même, en véritable apôtre.

"Au cours de sa vie laborieuse, Nocard n'a pas eu à attendre les honneurs. Très jeune, il entre dans presque tous les milieux savants:— à la Société de médecine vétérinaire pratique, à la Société centrale de médecine vétérinaire, à la Société de Biologie, à la Société de médecine publique et d'hygiène professionnelle, à l'Académie de médecine, au Comité des épizooties, au Conseil d'hygiène et de salubrité de la Seine, à la Société de pathologie comparée. Partout il prend une situation prépondérante, une influence incontestée; il fait preuve d'une rare intelligence, avec des idées larges, avec un esprit judicieux; il captive l'auditoire par son talent d'exposition, par l'élégance de sa parole, par son calme et sa courtoisie dans les discussions.

"Chevalier de la Légion d'honneur après la mission d'Égypte, il est promu officier huit ans plus tard, puis il est nommé officier et ensuite commandeur du Mérite agricole." [Ed.]

SIR VINCENT HUNTER B. KENNETT-BARRINGTON.

(Fellow.)

Sir Vincent Hunter Barrington Kennett-Barrington, of the Manor-house, Dorchester-on-Thame, died on July 13th from the effects of a balloon accident. He was born in Italy in 1844, the eldest son of the late Captain Vincent F. Kennett and of the daughter and co-heiress of the late Sir Jonah Barrington. Under his mother's will he assumed, in 1878, by Royal licence, the additional surname and arms of Barrington.

Sir Vincent Kennett-Barrington was educated at Eton and Trinity College, Cambridge, of which society he was a scholar. He graduated as Wrangler in the Mathematical Tripos, 1867, and in the next year took honours in the Law Tripos. He was called to the Bar by the Inner Temple in 1872. After leaving Cambridge, he was engaged as commissioner under the Geneva Convention during the Franco-Prussian war, seeing service at Saarbruck, Metz, Orleans, and the seige of Paris, after which he did good work in the relief of wounded during the Carlist war of 1873-6, the Turco-Servian war of 1876, and the Turco-Russian war of 1877-78. In these latter operations he was chief commissioner of the Stafford-house Committee. Before this, however, he had joined Lady Strangford's mission in relief of the victims of the then recent Bulgarian revolution. In 1885 Sir Vincent Kennett-Barrington was rendering similar services during the Suakin expedition, he did ambulance work in Argentina and in Brazil in 1891, and founded the Venezuelan Red Cross Society. In 1886 the honour of Knighthood was conferred upon him and he had also many foreign orders and distinctions.

He was also the possessor of the silver and bronze medals of the Royal Humane Society. He was for long associated with the St. John Ambulance Association, being made a Knight of Grace in 1889. As Government nominated member of the Metropolitan Asylums Board since 1883, he brought considerable knowledge to bear upon its fever and small-pox ambulance department; he became in time chairman of the Board's Statistical Committee, and, later, joined the Cholera Committee.

He was on the commissions of the Brussels Exhibition, 1876; Health Exhibition, 1884; Paris Exhibition, 1889; and Brussels Exhibition, 1898. Sir Vincent Kennett-Barrington was the author of many papers, some of which were read before The Sanitary Institute, dealing with the technical subjects to the study of which his whole life was devoted. He joined The Sanitary Institute in 1887 and was made a Fellow in 1900.

GENERAL NOTES.

The Eleventh International Congress of Hygiene and Demography was held in Brussels on September 1st to September 9th. The work of the Congress was divided into the usual Sections, and the questions of Tuberculosis, Preserved Food, and Sewage Disposal occupied an important part in the discussion at the Meeting.

The resolutions which were passed in the several Sections epitomised to some extent the result of the discussions.

These resolutions were in substance as follows, but the wording is variously recorded, owing probably to their being translations of the original text:—

Feeding and Hygiene for Infants.

That in the opinion of the section the feeding of infants should be a matter of constant solicitude on the part of the authorities and the section expresses the desire:—

That public charitable administrations should strive by all possible means to institute dispensaries directed by medical men for infants.

That young women having terminated their primary education should, more especially in schools of domestic economy, receive practical lessons on infantile hygiene, notably by making them attend at the dispensaries for infants.

That in all communes notices should be prepared on the question of suckling and the hygiene of the newly born.

That such advice should be headed with the maxim that no artificial method of feeding can possibly equal in value milk from the mother's breast. These notices should be distributed at marriages and at the registration of newly-born infants.

Tuberculosis and Sanatoria.

That human tuberculosis is more generally transmitted from man to man; nevertheless, in the present state of our knowledge on the subject, the Congress deems it necessary to take measures against the possibility of the infection of man by animals.

That the prophylaxis against tuberculosis is more especially the duty of the public authorities by means of a rigorous application of the laws and by regulations concerning the salubrity of habitations; by means of the police sanitary measures prescribed by the laws; by means of severe legislation on over-pressure and the duration of the hours of labour (in regard to which it is very desirable that there should be an international agreement); and finally by extending the communal, cantonal, or district bye-laws, which should be inspired by the local necessities and the interests of the benefit societies and trades.

That with regard to the assistance given to tuberculous patients by the popular sanatoriums, the dispensaries, the out-of-door treatment, the asylums, &c., the State should favour and aid in the largest measure possible private initiative and social associations, the departments provinces, communes, philanthropic associations, labour associations benefit societies, &c., and allow them to do what good they can according to the social aspirations and necessities that characterise each nation.

Milk and Food.

That only entire milk such as was supplied by healthy cows should be considered as milk.

That the International Congress of Hygiene and Demography, deeming

that a satisfactory food-supply is a powerful means of struggling against transmissible diseases, expresses the desire that an international movement should be officially supported having for its object the study and the popularisation of all means that may improve the food-supply of men and animals.

That the Commission instituted at the Congress of Vienna, 1887, for the study of international measures that should be adopted against the adulteration of alimentary products—a Commission of which Prof. Brouardel is the President—should prepare for the next Congress a new report on the legislation actually in force and the surveillance exercised in different countries over the food supply-trades.

Preservation of Food.

That there is no need to sanction the employment of antiseptics for preserved provisions.

That the processes of Pasteurisation adopted in private houses or in industries may assure the destruction of the microbes of tuberculosis in milk, but they do not sterilise the milk.

That the employment of food of bad quality or in course of being spoilt should be absolutely forbidden. The sterilisation of preserved foods should be complete. It is not possible to define by one single formula applicable to all cases how this can be done. The conditions vary according to the utensils used, the nature of the food, &c. The receptacles in which the food is kept should always be hermetically closed.

Cheap Dwellings.

That the State should encourage by all the means at its disposition societies which provide cheap dwellings, co-operative distributive societies and temperance organisations.

Water Supply.

That the supplies of water from chalk soils should be carefully watched, because the filtration of such waters may be faulty in consequence of the fissures that may occur in the soil. The water supply service being established, measures should be taken constantly to watch, not only the water itself, but the gathering ground whence the water is derived.

That the section, recognising the importance of the points raised and the interest of the communications made, without being able to arrive at any definite conclusions, expresses the desire that these questions shall be placed on the agenda of the next Congress.

Sewage and Sewage Treatment.

That the divers processes for the biological purification of the sewage of towns and waste waters from manufacturing or industrial establishments are connected with all the general principles the application of which opens out a new and fruitful era in regard to the sanitation of towns and watercourses. Whenever engineers, hygienists, manufacturers, or municipalities have to deal with the problem of the purification of sewage and waste water from factories, &c., they should seek inspiration from the above processes and may derive considerable benefit therefrom, and this whether they employ new bacteriological processes by themselves or whether they associate them with other processes that are already known and applied.

That the separate system and the combined or mixed systems can each be usefully employed, according to the circumstances of the case. It is only after both methods have been carefully studied and compared in each particular instance, and when the advantages and the incon-

veniences of the systems as applied to the local peculiarities have been submitted to full examination, that the sanitary engineer will be able and will be justified in attempting to formulate conclusions.

Disinfection of Trains; Dwellings.

That it would be an advantage to apply in all countries the same methods. It would therefore be useful to institute systematic experiments under the control of an International Commission so as to determine what method or methods of disinfection of cattle and goods trains best fulfilled the following conditions: cheapness, rapidity, efficacy, without deterioration of material.

That the disinfection of dwellings should only be effected by the employment of such processes and apparatus as have been authorised after very precise experiments made to verify their efficacy. The practice of the disinfection of dwellings in cases of transmissible diseases should be submitted to an administrative and technical control. The conditions of this control should be set forth with great precision.

Small-pox; Vaccine Lymph.

That in view of the difficulties experienced by vaccinators in hot climates when they seek to obtain animals for the production of lymph the employment of rabbits may be recommended. In certain exceptional cases, such as the impossibility of procuring suitable animals or repeated failure in attempting to inoculate animals, recourse may be had to vaccination from arm to arm in urgent cases and when all necessary precautions are observed.

That the employment of the virus of small-pox after several passages in the monkey and the consecutive inoculation of a susceptible animal as the rabbit is a question worthy of experimentation in an appropriate laboratory.

That the small-pox epidemics resulting from Mussulman pilgrimages are often more serious than those of plague. They should attract the attention of the Governments, and the Governments concerned should seek to take the appropriate measures to prevent such epidemics.

That in so doing, account of the religious sentiments of the native populations must be taken into consideration.

Tropical Diseases.

That in the absence of sufficient and positive knowledge on the origin of the different cases of beri-beri it is necessary that the matter should be more fully investigated. While awaiting the results of such an investigation it would be well to apply strictly to the coloured populations the general rules of hygiene which the experience of colonial practitioners has shown to be useful, and more especially those rules that relate to food and lodging.

Bacteriology Teaching.

That the Second Section, deeply convinced that micro-organisms have a very important influence on general questions of hygiene, but more especially on the question of food-supply, expresses the wish that bacteriology should be taught in the faculties of science on the same footing as physics, chemistry, mineralogy, botany, and zoology.

The Delegates appointed by The Sanitary Institute to attend the Congress were: T. W. Aldwinckle, F.R.I.B.A.; A. Wynter Blyth, M.R.C.S., F.I.C., F.C.S.; C. Childs, M.A., M.D.; T. W. Cutler, F.R.I.B.A.; Col. J. Lane Notter, R.A.M.C.; S. Rideal, D.Sc.; J. F. J. Sykes, D.Sc., M.D.

Kenny & Co., Printers, 25, Camden Road, Camden Town, London, N.W.

ERRATA.

Page 458, Line 14, to read:

MAJOR FIRTH (London) said he was not prepared to accept indol production as a satisfactory index of the presence of bacillus coli.

Page 462, Line 20, to read "*filter*" instead of "*filth.*"

Page 474, Line 35, to read "*working*" instead of "*marking.*"

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JOURNAL
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CONGRESS AT BRADFORD.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

THE COLONISATION OF RURAL ENGLAND,

AS FORESHADOWED BY THE GARDEN-CITY SCHEME.

By F. E. FREMANTLE, M.B., M.R.C.P.
County Medical Officer of Health for Herts.
(Member.)

THE scheme which gives its name to this paper is an original statement of several proposals, well-known severally to economists, but now for the first time grouped together by Mr. Ebenezer Howard in a small book entitled, "Garden Cities of To-morrow," first published by Swan, Sonnenschein & Co., in 1898. Without any personal experience of business, I could not venture to deal with such a subject were it not for the welcome support and advice of many business-men, to whom my warmest thanks are due.

The problem to be solved is two-headed:—

(*a*) The overcrowding of towns;

(*b*) The depopulation of the country;

and each must be considered as to its commercial bearings and its social bearings separately.

Mr. Howard has accordingly propounded the following experimental

GARDEN-CITY SCHEME.

It is proposed to *purchase a large agricultural estate*, say of 6,000 acres, over three miles square. The average price paid for agricultural land, in

Note.—The Proceedings of the Conference commenced with an Address by the Mayor, Alderman D. Wade, J.P. (*see page* 169.)

1897, was £40 an acre, and may be taken as sufficient for the purpose of this scheme. The cost of the estate is therefore reckoned at £240,000, say a quarter of a million.

By the end of this month an estate will have been secured* by the Garden-City Pioneer Company, which was formed last year for pioneering purposes only with a paid-up capital of £20,000. As soon as the reversionary deeds of purchase from the numerous owners of the property have been made out, *a Joint Stock Company* is to be formed with sufficient capital to absorb the Pioneer Company, to buy the estate, and to develop it on the best municipal lines. The share and debenture capital of the Company will bear a fixed return not exceeding 5 per cent., and all further profits will be applied to the development of the estate, the benefit of the inhabitants, and the establishment of a sinking fund.

The Estate will be carefully *laid out on an organised plan*, providing for the occupation of one sixth part only of the whole estate by the buildings necessary to a population of 30 to the acre.

Provisions will be included in the Articles of Association to *preserve the remaining five-sixths of the estate for ever as agricultural property*, with only farm buildings and certain public institutions upon it.

Applications will then be invited from manufacturers, co-operative societies, and private individuals for the *leasehold of sites* in Garden-City on the general lines of the drafted plan,—sites for workshops and factories, warehouses, offices, and residential buildings. Leases will probably be granted for all periods up to 99 years, buildings at the end of that time to belong still to the tenant, who may, it is suggested, be given 10 per cent. preference to any other applicant if he wish to renew his ground lease; but the value is to be re-assessed from time to time by a Committee representing both the Company and the tenants; and the Company, and so indirectly the community, will receive the benefit of the increased ground rent.

Some of the *buildings may be erected by the Company* in competition with those put up by builders, employers of labour, and speculative individuals.

By-laws, while interfering but little with individual taste or enterprise in building, will definitely prohibit insanitary conditions or overcrowding in any form.

Under special provision in the Articles of Association a body of

* This estate of 4,000 acres has now (August) been secured between Hitchin and Baldock in the north of Hertfordshire, on the Cambridge Branch of the Great Northern Railway.

trustees to represent the community and the Garden-City Company will be entitled after seven years to *buy out the Company at par*, or, if necessary, at 120 or 150 per cent. The Company, and subsequently the Trustees, are to be simply the ground-landlords and constitute a land-trust. They will only indirectly, through personal influence, be able to deal with municipal matters as such, which will, in course of law, be in the hands of the representative Urban District or Borough Council.

Such are the outlines of this scheme, for details of which we must refer those interested in it to Mr. Howard's book.

The benefits claimed for this scheme may be briefly stated.

The Community will reap the following advantages:—

If, for instance, 30,000 persons are placed on 6,000 acres bought at £40 an acre, the interest at 4 per cent. will necessitate only an average initial *ground-rent* of 6s. 6d. per annum each.

Low Municipal Rates. Parks and gardens, schools, churches, hospitals, municipal offices and other public buildings will occupy sites originally set apart for such purpose, and purchasable at the original price of the land; nor would they cost anything from demolition of buildings and disturbances of business. Road-making, sewerage, and the provision of light, power, water, and tramways are to be done on a pre-arranged plan, not requiring frequent alteration; and streets would never require widening. The rates will also be relieved by the application to municipal purposes of all profits, which usually go to the ground-landlord, after paying interest on capital at 4 or 5 per cent. and providing for a sinking fund.

Health. A point which it is unnecessary to elaborate before this Congress, after mentioning that the site chosen would be healthy in the first instance, and would be laid out and equipped with the requisite sanitary arrangements in accordance with the recommendations of an expert committee appointed for that purpose.

A good distribution and management of Public Houses.

Possibly it may be decided to make some arrangement in other trades by which *the number of shops and their distribution may be adjusted* to the needs of the people.

Advantages to Manufacturers and to Co-Operative Societies.

Low rent and low rates will affect both the annual expenses of their business and render extension of premises easy. The railway-sidings brought to their doors and a good and cheap central supply of light, water, and power will directly, and the healthiness of their work-people will indirectly, be of benefit to all, while certain trades will profit by

uninterrupted light and air and by provisions against smoke. The interchange of unskilled labour between agriculture and factories should also be of value. Furthermore, in the first Garden City all manufacturers taking part in the venture will by that fact secure a wide advertisement of their goods.

Advantages to Work-People both in Field and Factory.

Low rent and rates; a better home; no daily travelling; cheaper and fresher agricultural produce; general cheapness of commodities by organised methods of distribution; profit from cultivation of private garden or allotment in spare hours.

Existing Experiments.

That this is no visionary scheme is proved by the experiments now going on before our eyes in all parts of the country. As examples may be cited the factories of Burroughs & Wellcome, the Kodak Company, Sunlight Soap, and Cadbury's Chocolate.

The laying out of the City of Washington and the growth of North Adelaide outside the City of Adelaide, South Australia, without interference with its surrounding "Park Lands," are also illustrations in point, and the experience in Germany of Krupp, at Essen, who, during the past 40 years has been planting his factories and work-people further and further out of the town, point in the same direction.

The Cadburys' factory at Bournville, started mainly from philanthropic motives, is just such an experiment as could be wished for to test the merits of the garden-city scheme. The factory was crowded out of Birmingham. "When I first went into business," says Mr. George Cadbury, "we employed about 12 hands: when we came out here we employed 300, and now we employ 3,400. If we had been in town we could not have grown like this, and I believe that manufacturers will in time see that it pays to be out of town. It is a big undertaking for a manufacturer; I have been recompensed a hundred-fold for the effort." In December of 1901, Mr. Cadbury converted the whole of this property, as apart from the chocolate business, into a public trust for the benefit of the community. "The whole income," he says, "will go towards developing the idea. The income this year will probably be about £6,000, and I suppose £5,000 of that will go towards building cottages and improvements, and within 20 years that ought to be double; within 40 years it ought to be £20,000; within 60 years £40,000; and within 100 years £160,000. In 150 years you will see, by the natural progression at 4%, the income ought to be a million a year, and that will, we hope, open out two or three

Garden-Cities a year. By the Trust Deed, one-thirtieth of the land only can be used for factories. We hope to have factories of different kinds worked by electricity and obtaining power by the Mond gas apparatus, so that there will be no chimneys, no boilers, and no smoke to spoil the gardens."

Bournville is only four miles out of Birmingham; and those interested should visit it for themselves to see the fine workshops, the almshouses and convalescent home, the broad streets and picturesque houses of various design and ornament, the recreation-grounds and swimming-bath, the post-office, the butcher's shop, and Ye Olde Farm-house. For 6/- a week a man gets a cottage and one-sixth of an acre of garden free of rates and taxes, with six rooms and a bath; and by cultivating his garden, an occupation in which wife and children commonly take part, he not only saves the expense of amusing himself in town, but he is able regularly to save 2/6 a week. It is interesting to note that land in this way under spade-culture will realise £50 a year per acre, whereas under pasture it will not realise £5.

Let it be understood that this crucial experiment was undertaken by Mr. Cadbury with a view to reforming the drunkard and giving the poor man the chance of a healthy life. But Mr. Cadbury realised that the essential principle was to make him work and live a healthy life without being pauperised; it was essential, therefore, to make the Bournville undertaking pay; and it has paid abundantly.

Public Health in the Garden City Scheme.

What, then, is the part at present being played by sanitary science in the foundation of the first Garden City? In March and April of this year I had the privilege of inspecting, by request of the Directors of the Pioneer Company, four sites, and reporting to them as to their respective merits with a view to health. Upon reflection, it appeared obvious that the healthiness or reverse of any particular site in England was almost a negligible quantity. A sufficient supply of good water and a sufficient height above flood-water level are the only essentials; while a slight slope with a southerly aspect and a porous soil are advisable.

Having chosen a site and floated the company for its purchase and development, the Garden City Pioneer Company will be absorbed, and the new company will proceed to take scientific advice as to its development. Here is the unequalled opportunity of the sanitary profession. Is the water to be supplied under high pressure; is every house to have a cistern from the first; is an elaborate and costly system of water-borne sewage,

with all its attendant dangers, to be established, or is the cheaper and more natural earth-to-earth system to be adopted, at least as a beginning? How far can the building regulations be made elastic, to what extent must they be precise and rigid? A thousand questions suggest themselves at once. There is at present only one answer, the answer which it is the whole purpose of this paper to suggest, that all who deal, whether from the medical or from other aspects, with the vital questions of public health, should realise the immense possibilities of this scheme, and should proceed without delay to think out the practical details on which they are qualified to form an opinion. The Association has already formed a working alliance with the National Society for the Prevention of Consumption, and an informal Public Health Committee meets from time to time to discuss these problems. In the main, it will be sufficient to establish for the purpose a select consultative committee to decide on each point as it shall arise, and to fetter its decisions as little as possible. But it is obvious that many main guiding principles will have to be laid down from the first, principles on which there is still the widest difference of opinion; principles, indeed, which have never been focussed on to anything like this particular scheme. Let me add that the advice of those interested in the matter will be welcomed, either by post or in person, by the Secretary of the Company at Birkbeck Bank Chambers.

Applications.

In conclusion, let me emphasise the contention that the first Garden-City is a model, representing a certain principle of which the commercial, as well as the physical value appears to be proved;

That the whole principle of centrifugal decentralisation from the Cities back to the Country is the inevitable result of improved and yearly improving communication; it is a principle, like that of steam-power, that cannot be combated; and it behoves us to take warning by the deplorable blunder of Sir Robert Peel's Government in 1836, in refusing to discuss any scheme for the co-ordination of railways entering London;

That municipalities, therefore, that railway companies, and other large firms should be persuaded to effect colonisations of the country, rather than to plant row upon row of workmen's houses further and further from their work, and without any view to the proper development of the suburb as a whole;

That Government should lead the way in its capacity as a large estate owner; that the Admiralty, for instance, in establishing the proposed new Naval Base on the Forth, where it is estimated that before many years a

town of 30,000 will have grown up, should buy a large tract of country between St. Margaret's Hope and Dunfermline, five miles off, where are several factories for the employment of women; buy it now at low rates and allow its gradual development on an organised plan so as to secure for the tax-payer the whole future increase in value of the land and to ensure the health of the employées;*

That Colonies should adopt the principles of this scheme in the development of new commercial, mining, and administrative centres.

If the first experiment prove a commercial success, a wide vista of benefits to the Nation is displayed, benefits, however, which must inevitably react to the disadvantage of many at present prosperous interests. It is with a due sense of the gravity of these effects that I venture to make the following forecast:—

Existing manufactures will be removed from the towns, singly at first but later in numbers, and be developed as required with a considerable saving of annual expense, a matter of extreme importance in the struggle of the nations for commercial supremacy;

New manufactures will be established at far less cost than in towns;

The physique of the race will be improved;

Improved health and healthy surroundings, assisted by measures directed from the first against intemperance and overcrowding, cannot fail to bring in their train a moral improvement; while eventually

Agriculture and the value of agricultural land will improve, and

Slum-property in the towns will fall in value; slums will gradually disappear, and the towns will approximate in the course of centuries to the ideal of the Garden-City;

In fifty years the population of London, within the ten-mile radius, will stand still; in 100 years it will be diminishing, and there will be fewer people every year to pay the interest on our £40,000,000 of municipal debt—140 millions as it may well then be. Land-property in the towns is doomed.

The principle thus laid before us would appear to be the nucleus of changes, for better or for worse, that will stamp the twentieth century as indelibly as the principle of steam-traction stamped the nineteenth. The establishment of the first Garden-City is pregnant with results as great as those brought forth by the memorable trial-trip of "The Rocket."

* The creation of a dock-yard at Bootle is reckoned to have increased land-values by over £100,000, and to have sent up the rates in thirty years from £65,000 to half a million.

(For discussion on this paper, see page 553.)

COTTAGES FOR AGRICULTURAL LABOURERS.

By MARTIN SHAW BRIGGS,

Prize Essayist, Yorkshire Architectural Soc., 1902.

I.—Introductory.

DURING recent times the attention of most people has been drawn to the exodus of population from rural districts and the consequent swelling of our already unwieldy towns. Unless care be taken the much talked of Garden City Problem will oust from our thoughts that other problem: of how to improve the lot of "the Sons of the Soil." The English agricultural labourer differs in many respects from his neighbour of the town, and we in this district are more used to the latter. The rustic, as a rule, is a relic of Old England; he knows little of mechanics' institutes or of clubs of any sort, and his only recreation is probably found in the village inn. Surely then such a stay-at-home man must be well provided for in his cottage, for he makes good use of it. As we consider such a cottage in detail later on, we shall notice a few points where special requirements of an agricultural labourer must be catered for. Much progress has been made in such places as Bournville and Port Sunlight with the "out-of-town" housing problem, but in both cases we shall find that these villages are of a more philanthropic nature than the average English landlord approves of, and we must provide very small dwellings for such a poorly-paid class as that to which our labourer belongs. Many of our great landowners though, it must in justice be said, are turning their attention to this pressing need, and modern cottages of an improved and sensible type are not so rare as they used to be. The majority of such cottages are erected by the landlord, and happily the speculative builder is more rarely found here than in towns, as rural cottages are not now needed wholesale. Much depends also upon the character of the landlord as to the character of the cottage, for the dreaded model by-laws are an unknown quantity in many country districts, and the architect, if one be

employed, has full *carte blanche*. The experiments carried on by the corporations of our great cities are of little value for country-districts as their buildings are generally on cramped sites and often on the flat-system. Still, their rules as to height of rooms, etc., are as useful in country as in town. The so-called cottages erected by artists and other Bohemians to recruit in the country at the week-end are also of no use as types to follow. The published plans of such places seem to be chiefly composed of "ingle-nooks" and "dens" with utter disregard for sanitation.

It is difficult to fix any estimate of price to a cottage, as style and materials affect it so much. A good deal may be saved by an architect who has a practical knowledge of the cost and worth of his material. Good stone cottages with parlour, living-room, and detached wash-house cost £350–400. The cost of a good brick cottage, such as we build in blocks of from two to four, is hardly ever less than £200, and the necessary rent is heavy for a labourer's pocket. Concrete cottages can be built for slightly less than this. In a speech on "Rural Housing" on May 11th, Mr. Rider Haggard said that the landlords were not rolling in wealth, but impecunious. He said that a pair of cottages could not be built for £400, and would not pay at 1s. 6d. a week rent. He suggested that the Government should buy plots of land, and said that if something were not done soon, a crisis was to be expected.

The idea of a common-room in cottages built in small blocks seems to be rather Utopian. Such a room is generally employed either as a reading-room, parlour, or wash-house. The last is most feasible perhaps, but we have yet to find the happy spot where two or three separate families will sit, eat, or work harmoniously together without the strife of tongues. In designing cottages, the prejudices of the cottager must be taken into account, as well as regard for his health.

II.—PLAN.

In the case of cottages in the country we may begin by assuming unlimited space for the site, and therefore it is not too much to ask for a garden for every cottage. There should be two entrances even to a house of this size, all the parts of the house which do not improve the view being at the back. In this way the smallest house may have a tidy front approach, and with a well-kept path and garden this is a great improvement, as far as appearance goes. I am also assuming that these cottages will be built in blocks of from two to four, this having been found to be the most economical and successful system.

First of all we must determine the accommodation required on the ground-floor. On this point there is the greatest diversity of opinion and

practice, but we may assume as indispensable a living-room, free from such furniture as a sink or copper; secondly, accommodation for the said sink and copper, with provision for all dirty work to be done there; thirdly, a ventilated cupboard or small room to serve as a larder. As optional we may class a parlour and a detached wash-house. The most elementary type of plan I have seen is that adopted by the Liverpool Corporation for their concrete flats. Here there is only a living-room 15′ 0″ × 10′ 3″ with a large fireplace, and sink and copper together occupy a space of only about 4′ 0″ × 3′ 6″ at the back. The want of a larder is here evident, as a living-room cannot be kept cool enough for the storage of food. The space for washing is also too small. In making these criticisms, however, it should be remembered that these flats only cost £100 each. The Guinness Buildings in London and Dublin, erected since 1889, have living-rooms of 150 sq. ft. area, and a ventilated food-cupboard. Common wash-houses and bathrooms are provided. The new model dwellings at Bristol (1901) have living-rooms 14′ × 14′ (1st class), or 14′ × 13′ (2nd class), and wash-houses 8′ 0″ × 4′ 6″. The living-rooms are well lit, have kitchen-grate and oven, and the wash-houses contain boiler and small coal-cupboard.

From these examples we may assume the following as absolutely essential: (i) a living-room of 150 square feet area containing range, (ii) a ventilated food-cupboard, (iii) a small wash-house or scullery with copper or sink. (iv) To these I should like to add an innovation to be described later on, viz., a bathroom.

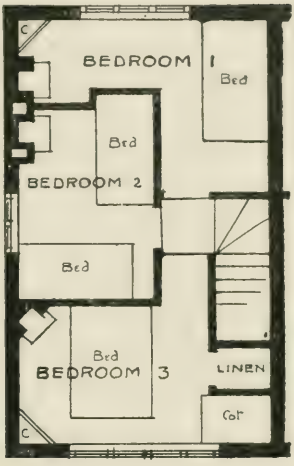
We will now consider two types of plan in detail, of which most others are modifications.

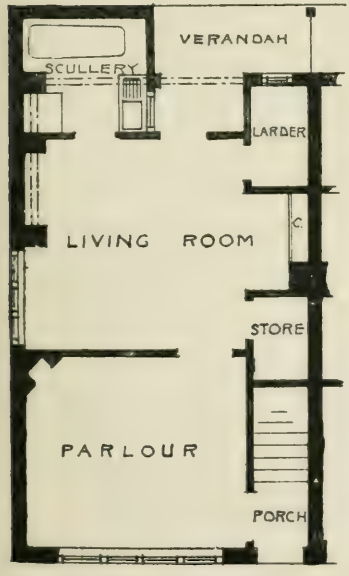
a. The front door enters a lobby about 3 ft. by 3ft., with stairs (2 ft. 10 in. to 3 ft. wide) running up, and with the living-room door on the left. The living-room is about 160 square feet, and includes a large fireplace and plenty of cupboards. An angle-cupboard is a feature that one could wish to see more in modern cottages. (The Queen's recent remarks at Millbank on the subject of cupboards are worthy of note.) A good left-hand light for cooking is needed. The best room in the house, whether kitchen or parlour, should face towards the road. The *height* of these rooms downstairs is a matter of much difficulty. Various experienced men hold that as only oil is burnt in country cottages and little of that, the danger of noxious fumes collecting is reduced to nil, and that the height should be from 7 ft. 3 in. to 8 ft. The bye-laws insist on 8 ft., but many model dwellings are made 8 ft. 6 in. to 9 ft. 6 in. The picturesqueness of many old cottages is in most cases due to low eaves, and consequently low

TWO TYPICAL SKETCH-PLANS.

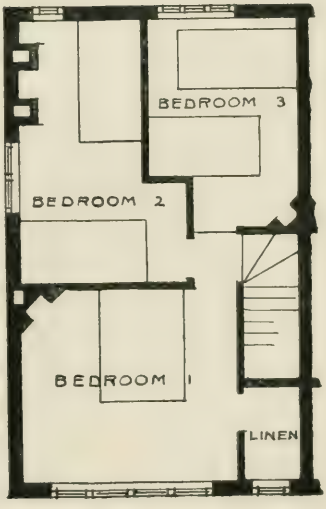
Note.— The coal-place and EC being detached from the house, are not shown on these plans.

A.

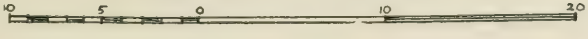




B.



SCALE OF FEET.



rooms occur. On the whole, for an ordinary small dwelling, 8 ft. seems high enough where no gas is burnt. In such a room as I have described the fireplace will act as a reliable extract flue. Out of the living-room one door opens into the larder. This need not exceed 3 ft. in width but should have shelving, best in stone, though the additional cost may be prohibitive. This small room of course should have a window if possible, but if not, air-grates will supply the necessary ventilation.

The other door from the living-room enters the scullery (10 ft. by 6 ft.), which in a cottage of this sort is the most difficult part of the plan. In a recent article in the *Builders' Journal* by Mr. Wyand, a most interesting solution of the problem was given. In a space only 6 ft. by 5 ft., room is found for a sink, a 20-gallon copper, and a bath with hot and cold water supply. Mr. Wyand explains that such a system would provide a bath for an additional cost of £3, as against £30 required for a small bathroom and hot water supply with the cheapest of fittings. He contends that it is only lack of opportunity that keeps the "British workman" from this much needed luxury. From the furnace-pan of the copper "a short length of pipe is taken as a hot water bath-supply, and finished with a ground plug bib-cock." This seems a most successful solution of a long-standing difficulty, and the fact that the scullery is not in use when the bath would be required is an additional factor in its favour. (I do not at all like the idea of having the bath in the living-room, either in the floor, or under the table-top forming the kitchen-table.) The sink should be of the Scotch pattern or "jaw-box," which can be used as a wash-tub. Cold supply only is needed. Many authorities consider that a cottage scullery sink should not be trapped, as traps are apt to get out of order, but should be emptied by an open pipe to discharge over a "Duckett's" 3-gallon tipping basin kept above the ground. These basins are trapped on the drain side. They are much more used in the North of England than in the South.

Outside the scullery it is very convenient to have a verandah in which the agricultural labourer may get rid of his boots and as much of England's native soil as remains on them, and where he may put down his implements of toil. Here also much of the washing may be done instead of in the open air.

The drainage of such cottages as we are considering is now carried out almost exclusively on the earth-closet system. All systems of water-carriage are apt to be ineffective in small villages, and flimsy fittings are very often put in work of this description. The earth closet should be isolated from the house, but must not be far away. House refuse is best

kept in the galvanised dust-bins sanctioned by the by-laws, these being much better than brick ash-pits.

b. The second type of plan differs from the first in that a parlour or sitting-room is added. This is simply pandering to a popular prejudice, and that of no long standing, for the old cottages had as a rule only a large kitchen. The room is used only as a Sunday afternoon sitting-room for visits of "notables" and friends and on similar important occasions, and is made a showroom for photographs and ornaments. Here also, in Yorkshire, we keep the harmonium. Such a room need not be made as large as the living-room and need not have a large fireplace, but should be well lit and entered from a front lobby. In this case our kitchen becomes the middle room, but should not be reduced in size. The sink must in any case be kept out of these inhabited rooms, and so also the copper, as described in plan A. In my opinion the parlour is an unnecessary adjunct, as a large well-lit kitchen is up to the expectations of the agricultural labourer. Detached wash-houses of course have obvious advantages, and where money permits may well be adopted. The size should be about 8×6ft.

In both these plans I have assumed that an upstairs floor is to be provided as that is now generally thought to be the best way. The bedrooms in either case should present no difficulty. I am not going to make you shudder with all the sickening stories I have heard of villages where disgraceful conditions prevail, but I will state as an accepted canon of decency that a cottage for a family must have three bedrooms.

The area of bedrooms should not be less than 80 feet, and one of them, at least, should be larger. On our first plan A we have 250 square feet, which just gives us three bedrooms, rather small ones. On our plan B we have space for three fair-sized rooms. Linen-cupboards, of course, are essential, and beds may often be fitted into recesses over a lobby or larder where there is only a 4-foot width. In Scotland and other parts of the country there is often a bed-recess in the kitchen, but this is more picturesque than modern, and a third bedroom is much better. When cottages are built with only two bedrooms I consider that the local authority should have the power of limiting the number of inhabitants. Every bedroom should have a small mantel register fireplace. Though I have said that the ground-floor rooms may be low, we must remember that the cottager sleeps with his window shut and will never be converted to anything better. So we must give him higher rooms. This height may be obtained in the roof, but anyone who has had experience of building

inspectors must know that the exact point to which splaying of the ceiling is allowed to reach is a difficult matter to decide. Rooms with the slope of the roof forming a large part of the ceiling may be made even warmer than an ordinary flat plaster ceiling by laying the tiles on a bed of concrete plaster over the backs of the rafters. Boarding and felt are as expensive and less effectual.

[*This discussion applies also to the paper by* Dr. F. E. Fremantle.]

Councillor F. W. Jowett, Chairman of the Bradford Health Committee, said one of the chief ideas running through Mr. Briggs' paper was the provision of gardens in connection with cottages. This was a very important matter, and one that ought to receive more consideration. The question of agricultural labour was affected by it. They heard a good deal nowadays about the provision of allotments. Generally allotments were understood as a plot of ground away from the man's house, to which he could go after his working hours. If these gardens, however, were to be properly used they must be attached to the man's homestead, so that whenever he had a spare ten minutes he might go into his garden and do what was necessary to keep it in condition to produce something worth producing. There were certain serious disadvantages about the provision of separate allotments. The distant allotment took the man away from his family, and frequently became the centre of certain companionships and pursuits which were not for the benefit and welfare of the people concerned. There had been many instances where the garden allotments away from the home had produced gambling. On the other hand, the attachment of the garden to the man's own home gave him every facility for working it properly, and gave him a love not only for the garden, but also for the homestead. He was pleased also to notice Mr. Briggs' observations about the necessity for two doors. In Bradford there were a good many people of opinion that the back-to-back houses were not objectionable, and held that practically the present method of building houses came to this, that two small rooms were provided instead of one large one, as was the case with the back-to-back system. But there was a fallacy in the juxtaposition of these two ideas, for it did not necessarily follow if there was only one room that there could not be two doors to it. If the ground available was not sufficient for two rooms, a parlour and a living-room, then by all means do away with the parlour, and have a living-room with two doors to it, and let it be a well-built through house. The Bradford Corporation were at the present time proposing to build some houses, in fact the streets were being made and the drainage had already been completed, in which certain of the features mentioned by Mr. Briggs would be included. They had a fair sized living-room, with an average of 14 ft. square, and a very small scullery, with a copper and a sink, and a bath as well. There was a small enclosure at the front and a good

yard behind, and two bedrooms. He hoped that authorities would endeavour in the near future to do something towards the solution of the agricultural problem by having gardens attached to the houses, and thus creating a much needed love for the land and giving the people greater interest in their homes by combining the home pursuits and the garden pursuits.

MR. EDWIN B. JAY (Epsom Rural District Council) said he could not entirely follow the paper which had been read by Mr. Briggs. He was a member of the County Council of Surrey as well as of the Urban and Rural District Council of Epsom, and might claim to have some experience of municipal life, and looking at the practical side it was a matter of pounds, shillings, and pence in the agricultural places. How were they going to find the means for building such cottages as had been described by Mr. Briggs? Whilst it was absolutely necessary in rural districts that there should be healthy rooms, it was also absolutely necessary that the present generation should be taught habits of personal cleanliness. It was little use to have healthy homes unless the people had cleanly habits, and he ventured to think that in many rural districts the landlords had come forward very liberally in the way of providing houses for their tenant-farmers. He should like to see in rural districts homely pastimes and other things of the sort got up for the young people, to encourage them to stay in these districts instead of going to the larger towns. If something could be done to provide some kind of amusement and some employment which would help them to appreciate the advantages of rural life, by finding them pleasant occupation after their day's toil, it would be a very great advantage. But if they talked of bath-rooms and such things in connection with cottages it began to look rather like building villa residences, and they know that in agricultural districts the labourer was not receiving more than from 15s. to 18s. a week, and that meant that he could not pay more than 2s. 6d. per week for rent. He hoped that the Councils of rural districts would not press landlords to go to extra expenses for cottages which, however they might do for urban districts, would be totally unsuitable for rural districts. They in the rural districts could build healthy homes without going in for the large expenditure which urban districts demanded. He hoped that the matter of agricultural cottages would be dealt with in a liberal spirit by the landlords, and that anything else that could reasonably be done would be done to induce people to stay in the villages, where they were so sadly needed on the farms.

ALDERMAN E. S. HINDMARSH (Gateshead) said the garden city ideal was a very admirable one, but he was afraid that the difficulties in the way would prevent it being carried out. He had been to Messrs. Cadbury's place, and it was most delightful. Nothing could be more desirable than the homes in which the people lived and the gardens which they had to cultivate; but the question which occurred to him was what they could do with large towns of a manufacturing kind. If they had an estate sufficiently large, and removed a population

of a hundred thousand people to it from a locality which was at present crowded, it would no doubt have a wonderful effect, but the difficulty would be to move the manufactories out of which the people got their living. To take the manufactories out of a town to some place a few miles out in the country would add very considerably to the cost of the manufacture, and would reduce the former town to almost the state of a wilderness. He was sincerely desirous for the good housing of the working classes, but it was obvious that in trying to improve in one direction they might make very serious difficulties in another direction. The description of the kind of cottage which Mr. Briggs advocated raised doubts whether it was at all possible to bring it within the reach of the agricultural labourer, who, he was told, received 14s. to 18s. a week; there might be differences in different districts, but if the wage was 14s. that was a most miserable wage, and if they wished people to remain in the country they must, at any rate, pay them a fair remuneration. The work was of a very arduous kind and deserved good pay. It appeared to him that an elaborate cottage of the kind which was now advocated would run to about 6s. or 8s. a week in rent, or even to 10s., and what was wanted was a suitable place at 4s. or 5s. at the most. In his town there were plenty of comfortable houses at 5s. a week rent, and tenanted by men who were earning not 14s., or whatever it was that the agricultural labourer got, but 30s. or more. It was a very desirable thing to get the people out of the slums, but he would remind the Conference that if they got their model cottages and city gardens and removed people into them and had the public-house near at hand, they would have the slums again in six months' time just as bad in the new place as in that from which they had been removed. They must get to the root of the whole matter. There were people living in the town slums to-day who could each have a house of their own if they would only use their money in the right way. If the people were converted to the right use of money they would soon provide homes of their own. As the members of the Conference knew, the local authorities had powers to deal with slum property if it was in an insanitary condition and not suitable for people to live in. They could say to the owner at once that he must put this property into a sanitary condition, and that if he did not they would close his property under the Public Health Act. But they would find, even in the slum districts, that there were decent people living in those districts, and whose houses were not at all of the slum character. There were some houses in such districts in which he could sit down comfortably and eat off the table, whilst the very next house might be one which they would not enter on any account, and in which they could see and smell the filth and dirt as soon as they opened the door. What was needed was an appeal to the individual, and when that had been made with success they could improve the environment in a very short time. All this, of course, was very difficult to do. He had been concerned in sanitary matters for thirty-four or thirty-five years in a town which had been so very much improved that he sometimes said that Gateshead had

become a health resort. The Mayor had stated that the Bradford death-rate was 16 per thousand. He should like to know whether that figure was for a few months or a year, or five or ten years, because he thought that Gateshead would compete favourably with Bradford, though 95 per cent. of its population was a working class population.

ALDERMAN COE, J.P. (Chairman of the Halifax Health Department) said perhaps it would not be out of place for him to mention that according to the returns of the Registrar-General, Halifax had the lowest death rate of any of the great towns in the Kingdom for the last three years. As to the authorities having the power to deal with the housing of the working classes he only wished that they had such power. They had had a very sorry object lesson in Halifax. They were determined to clear away the slums, and put into operation Part 2 of the Artisans Dwellings Amendment Act, but they should never try it again. It was quite true, as Ald. Hindmarsh had said, that when they took their medical officer round to examine an area there was a difficulty in the first instance in the fact that they found in that area beautiful little cottages as clean as a new pin and in which they could sit down and dine without any discomfort. They found that some of the houses were good houses of a recent character, modernly built houses. These were not slums at all, though they happened to be in the slum district, and in dealing with the slum area as a whole they had to take the new houses and allow full compensation for them, and this was rather a serious matter for the rates. In the case to which he referred they did what he thought most sensible, but which in the future they would be very careful to leave undone. They purchased eight lots of property without getting the borrowing powers. He quite admitted that that was a very serious thing to do, but they tried to make the end justify the means. They knew as well as he did that when an idea was abroad that the Corporation was likely to want to purchase certain property it rose wonderfully in value. They wanted in this case to avoid that rise in value. They cleared all the insanitary area, and it remained clear to-day. They paid the money for it, and their own Town Clerk did all the transferring and other lawyer business and they got all the area cleared, and arranged what they were going to do with the ground. The people who were affected by the clearance said they hoped the Corporation were not going to send them to another locality, because their work was there, and they, therefore, did not want to be removed, and added that if the Corporation built them nice places two or three miles off in the country they would not go. There was a difficulty at the beginning. They had plans drawn out of a block with a nice garden in the centre, prepared suitable places for housing people in all sorts of different circumstances. But now they wanted the borrowing powers for the money which they had spent before they had got the powers. They therefore went up to the Local Government Board, and then came the crux of a very serious difficulty. The Halifax Corporation had spent an immense amount of

time and trouble in the preparation of these plans. They had even placed at the end of the block a house for one of the inspectors, in order that he might go round and see that the people were keeping the houses clean. But the Local Government Board said they could not pass the plans, but suggested a model building which the Board thought we would like to build. These might be all right for the South of England, and perhaps for London, but they were not right for Halifax, and would not do at all for that town. There was not a house in the lot which could be let at less than £12 a year, and the Halifax authorities did not want to put up houses to let at £12 a year, but houses suitable for the people who had been detenanted.

Mr. Thomas A. Guy (Bradford) said he could not help feeling, after what they had just listened to, that the difficulties of dealing with insanitary areas had been somewhat exaggerated. They in Bradford had had a very different experience of the Local Government Board to that related by Alderman Coe. They had dealt with, and were still dealing with, an area which was insanitary to a degree. In the district to which he referred there was a death-rate of no less than forty-three per thousand per annum. When they drew out their plans there was a great difficulty in the fact of the dislike of the people to remove, but the Corporation had, nevertheless, gone two or three miles from the district to build the bulk of the houses that were to replace those which had been pulled down, and they had only rebuilt upon the same ground a certain number of houses for a few of the detenanted people, and none of these houses were of any such rentals as the previous speakers had been talking about, but were at considerably less figures. These houses started at a rental of 2s. a week, and they went up to 5s. a week. He wished to point out that when they find insanitary areas in their midst, they must not let such little difficulties as the sentimental desire of the people to continue to live where they had lived for many years stand in the way of the sanitary improvement of the cities. The question of the slum areas was of such a serious nature that they ought to minimise the difficulties rather than increase them. With regard to the garden city scheme, he felt that they must all feel the force of what had been said by Alderman Hindmarsh. What could they do with such a city as Bradford? It was all very good and admirable to consider such a scheme in relation to some place where a new industry was going to be started, but it was utterly impossible to apply such a scheme to such large manufacturing districts as Bradford, Gateshead, and Tyneside, and so on. They could not remove the established industries into the rural districts, and what they should chiefly concern themselves about was to improve the districts where the population was at the present so dense. He did not want the Conference to go away with the idea that Mr. Jowett was against garden allotments. There had seemed to be some danger that his observations might be interpreted as against garden allotments, because he was more especially advocating that the garden should be attached to the houses them-

selves, but he was perfectly sure that Mr. Jowett had not intended to convey that impression. In Bradford they were making very great strides in the direction of allotments already, although it was not practicable to any large extent to secure the attachment of such allotments to the houses, and he hoped they were not going to let a preference for allotments attached to the houses stand in the way of their doing what could be done in cities where they must all admit that the better ideal was impossible. He thought that where allotments distant from the houses were under proper Municipal control, the evils which Mr. Jowett had referred to could be remedied, and indeed, might be entirely prevented. There could be no doubt, too, that the main principles advocated in the paper of Mr. Briggs were the right thing, because those who visited the rural districts could not but feel that there should be some improvement on the wretched hovels which served as dwellings for the labourers in the agricultural districts—specially in the Midland Counties—and in some of which they could hardly stand erect. Such dwellings were a disgrace to civilisation; and the thanks of that conference were due to the readers of papers which contained valuable proposals for the benefit of the people in such districts.

DR. DABELL (Nottingham) said that it was very well for cottages to be built in the middle of their own garden in the country districts, where there was plenty of land, but what were they to do in the large and populous districts in the cities? It was absolutely impossible to put cottages or houses in the middle of their own gardens in the cities. He should like, however, to strongly recommend what had been done in Nottingham, dating back to a time before he went to the city. The Corporation set aside some acres of land for allotment gardens, and these gardens were practically all taken up, and it was very rarely indeed that there was one vacant. These provided healthy occupation and recreation for working men when the ordinary day's work was finished, and they also provided pleasant recreation for the wives and children of these working men. The whole families often went there and spent the whole evening, and even had their meals. There were many acres of such gardens in Nottingham, and he felt that they could almost claim to have a garden-city. But this did not solve the housing of the working classes question. It still left matters pretty much as they were. The question was hedged round with many difficulties. There was the cost to the rates of any housing scheme, which was considerable in many places, and they had also to deal with the fact that the people who lived in these overcrowded dwellings were not anxious to leave them. The people wished to be near to their work, and in connection with some trades it was very well that they should be; but he could not help thinking that if the people were taken a little farther away, and had to walk to and from their work, it would be all the better for them. In cities which were not so large as Manchester and Liverpool it would be a good thing indeed if the municipal authorities were to appropriate some land near the outskirts and there put up workmen's dwellings, so that the

people would have the healthy recreation of walking backwards and forwards. It had been very justly stated that the people who lived in the slums made the slums; but, at any rate, they could ensure that the overcrowded condition of the present city slums should not be reproduced in any new district which was built. But if they removed this particular kind of people from these districts, and had them placed in better surroundings and gave them more fresh air, they would set a better example, and it would be one important stage in the education of the slum dwellers. He took it that this was a question of education at the finish; and that with education the change in surroundings would have a better influence on the mental capacity of these people. Let them at all events remove the children, so that under the influence of better education and surroundings and more open spaces and so on, they would become better citizens in the future. He thought that was an important point indeed. Another point was that so long as there were slums in a city, so long would there be people who were ready, willing and even anxious to live in them, and therefore one of the most important steps was to take means to pull these slums down, and then the people could not live in them.

Dr. Fremantle (Hertford C.C.) said he was extremely glad that it had been his fortune to read his paper before that Conference rather than before his colleagues, the Medical Officers of Health, because this garden-city scheme was one which must stand for its merits entirely upon its financial possibilities. He thought that all who had read about garden-cities were agreed that these were pre-eminently satisfactory in their ideals. If he had read his paper before the Medical Officers of Health there would have been a chorus of approval in regard to the sanitary aspect of the question; but the whole question depended upon whether it was practicable, and therefore he was grateful for the remarks which had been offered on that point, and based upon the very solid ground-rock of negative criticism. Upon the question whether it was practicable or not, he was pre-eminently a student. His attitude was similar to that taken up by Mr. Chamberlain in reference to fiscal policy. He did not think that they should take the present state of things as a thing definitely established for ever. It might be so, and if so, he could only say that he was sorry that they must go on with the tinkering with the problems of the cities, as he might call it. The question was whether they were not just at the beginning of an ebb tide and going to turn back again, and gradually work back into the country; and that was the question which he had tried to discuss in that paper. In considering that question he wished them to dissociate themselves from the state in which they at present found the large cities, and to look at the general principle in relation to the whole country. That was what the advocates of garden-cities had tried to do. They took into account the most favourable opportunities. Here was Mr. Cadbury of Birmingham. Thirty years ago he employed 300 people, and, whilst he felt the need of extension, he found it would be very difficult and

costly to extend where he was, and he therefore moved the whole of his business to Bournville, which was outside the City, and the movement had been a great financial success, and now his works employed 3,000 people. He wished to emphasize the point that the scheme would in all instances stand or fall by whether or not it was a financial success. How far was that success going to be repeated in other cases? He could not refer to Messrs. Lever's Port Sunlight undertaking in quite the same way. That was on different lines. Messrs. Lever did not try to make Port Sunlight a financial success. Messrs. Lever's idea was that of a philanthropist; Mr. Cadbury's was not. The city garden scheme was a proposal to make even larger experiments with other businesses which could be developed in a similar way, and if they could get a town of 30,000 established as a financial success, that would be a valuable proof of the soundness of the principle. They might perhaps apply the principle, for instance, to the new naval base of the Forth, where the place had got to be developed. Wherever there were new industries to be established they could apply the principle. As to the question of how far the principle would work, he hoped that eventually they would get back in some way to tackle the question of the big towns. But they must consider the matter on general principles. Of course, they could not move from such a thing as the river Tyne. In the Tyne or the Thames they had a definite commercial asset, and those to whom the river was of use could not leave it. Removal could only be suggested in cases where a business could be removed from one place to another without financial loss. The whole thing was an experiment with a principle which might possibly benefit the general principle in the end, and to show how they could turn the aggregation of population in the towns, which, they must remember, was only a product of the last 100 years, into a new channel.

MR. BRIGGS (Otley) said that, like Dr. Fremantle, he was glad that his paper had not been read before his colleagues, because he felt that the matter of improvements in cottages was more for District Councils than for the architects. In reply to Mr. Jay, he might say that the cost of a bath would not be more than £3 in addition to the ordinary cost of a house. He had had to omit some figures from the paper owing to lack of time. In regard to the question of games or amusement, these were generally provided for in institutes or some specially provided ground, and in both cases were outside the scope of the paper. In reply to Ald. Hindmarsh as to the question of cost of the cottages, the paper contained plans of two different types of cottages. The first type would cost £300 in stone, or £200 in brick, or £150 in concrete, which had not yet been much adopted; and the second kind of cottages would cost 25 per cent. more. The cottages of the first type were the smallest that could be built at all, compatibly with decency.

THE MUNICIPAL INFANTS' MILK DEPOT.

By G. F. McCLEARY, B.A., M.D., D.P.H.

Medical Officer of Health, Battersea.

(Member).

IT will hardly be disputed that one of the most remarkable features of the vital statistics of this country during recent years is the continuance of a high infantile mortality. Since 1875 the general death-rate has gone down from 22·7 to a little over 16 per 1,000, but our infant mortality is as high now as it was fifty years ago, and in fact the highest infant mortality figure since 1850 was reached in 1899, when the number of deaths under one year was no less than 163 per 1,000 births. This heavy loss of life requires explanation. It cannot be contended that the great improvements in sanitation which have taken place since 1875 and which have contributed to bring about the remarkable reduction in the general death-rate have had no influence on children under one year. We know that infant-life responds readily to changes in environment. It would appear that some condition specially inimical to child-life has come into operation in the last few decades. May this not be found in the growth of the practice of artificial feeding, which every medical man of long experience will agree has occurred in recent years? Be this as it may, there is no doubt that a large proportion of infant-deaths are due more or less directly to improper feeding, and it is generally recognised that in order to bring about a material reduction in infantile mortality, it will be necessary to effect something like a revolution in the methods of baby-feeding now employed in the poorer districts of our urban centres of population.

The methods adopted hitherto by sanitary authorities have been chiefly educational. Leaflets containing instructions in infant-feeding have been widely distributed, and during the last few years women health-

visitors have been appointed by many sanitary authorities to give personal instruction to mothers in this subject. Much may be hoped from work of this kind, but up to the present it is doubtful whether these educational methods can be shown to have had a distinctly appreciable effect in preventing loss of infant-life. It must be borne in mind that the artificial feeding of infants is a matter of great difficulty, demanding watchfulness and care and the most scrupulous cleanliness; and it need not surprise us if many of the mothers in our poorer districts with their wretched housing-accommodation and their multifarious household-duties, should fail to carry out successfully the modification and storage of cows' milk recommended in the usual municipal leaflet on infant-feeding.

The Municipal Infants' Milk Depot is not to be regarded as in any way replacing this work of instruction; it is really an important addition to our educational appliances. But it is something more; it not only affords a striking object-lesson in the preparation and storage of infants' food, but it also supplies the food already prepared, and supplies it in such a form as to reduce the possibility of contamination within the home to a minimum. What is the problem of artificial infant-feeding amongst the poor? It is to supply the baby with a nutritious food which it can digest, which is free from chemical preservatives and pathogenic organisms, and is supplied in such a form as to prevent home-contamination. To attain these objects the Infants' Milk Depot supplies cows' milk free from chemical preservatives, modified to suit the infant's digestive capacity, sterilised to destroy the contaminating organisms received during transit, and supplied in stoppered bottles, each bottle containing sufficient food for one meal and no more, so that home-contamination, unless wilful or due to culpable carelessness, is prevented. This system of food-supply was originated by Dr. Leon Dufour of Fécamp, who opened his institution, the Goutte de Lait, in 1894. Similar Gouttes de Lait have since been opened in many other French towns. Some are municipal institutions, but the majority are managed by philanthropic societies. The first depot of the kind in this country was opened by the St. Helens Corporation, in 1899, on the advice of Dr. F. Drew Harris, the Medical Officer of Health. In the following year municipal depots were opened at Liverpool, Ashton-under-Lyne, and Dukinfield, and since then Battersea, Leith, and Bradford have taken the same step.

The method of working an Infants' Milk Depot varies to some extent in these towns. The method employed in the Battersea Depot is as follows:—The milk is supplied by a local dairyman and arrives in the early morning. It is guaranteed free from chemical preservatives, and to

contain not less than 3·25 per cent. butter-fat. The first process is the modification or humanization. Three modifications are employed. The first contains two parts water to one of milk, seven ounces of cream and seven of lactose being added to each gallon of the mixture. This modification is given to infants under three months old. The second modification, which is given to infants between three and six months old, consists of equal parts of milk and water, with five ounces of cream and lactose added per gallon. The third consists of two parts milk to one of water, with three ounces of cream and lactose added per gallon, and is given to infants over six months old.

The milk having been modified, it is bottled and the number of bottles and the quantities contained are set out below :—

No.	AGE.	No. of Bottles per day.	Amount per Bottle.	Amount per Day.
1	Below 2 weeks old	9	1½ oz.	13½ oz.
2	Between 2 weeks and 2 months old... ...	9	2½ oz.	22½ oz.
3	„ 2 and 3 months old...	8	3 oz.	24 oz.
4	„ 3 „ 4 „ „	7	4 oz.	28 oz.
5	„ 4 „ 5 „ „	7	4½ oz.	31½ oz.
6	„ 5 „ 6 „ „	7	5 oz.	35 oz.
7	„ 6 „ 8 „ „	6	6 oz.	36 oz.
8	„ 8 „ 12 „ „	6	7 oz.	42 oz.

After bottling, the stoppers are closed and the bottled milk is heated by steam and kept at a temperature of 212° Fahrenheit for from 5 to 10 minutes. It is allowed to cool, and then is supplied to the consumers. Each mother on first coming to the depot is given a leaflet of instructions as to the proper method of using the milk. The method is very simple. When feeding-time arrives, all she has to do is to place the bottle, unopened, in some warm water till the milk has reached body-temperature. The bottle is then opened, a small teat put on the mouth, and the baby takes its milk from the sterilised bottle direct. The use of the long tube feeding-bottle is obviated.

Turning now to the question of the effect of these establishments on infant-mortality, I think it doubtful whether any figures exist which express their full value. They have not yet been in operation on a sufficiently large scale, nor for an adequate length of time, to have had a striking effect on the infantile death-rate, and the only statistical method which appears to be available is to compare the death-rate amongst the children fed from the depot with that in the district from which they are drawn.

This is the method employed at the French Goutte de Lait, where the figures certainly show a striking difference in favour of the children fed from those institutions. Dr. Drew Harris has extracted similar figures for the St. Helens Depot for the years 1899–1902. He finds that in the year 1899 the death-rate per 1,000 among children fed from the depot was 103, as against an infantile mortality figure in the town of St. Helens of 157. In the year 1900 the corresponding figures were 102 and 188, and in 1901, 106 and 175. I have extracted similar figures for the Battersea Depot from June, 1902, when the depot was opened to December 31st, 1902, a period of six months. During this period 558 children were fed on the milk for varying periods; 32 of these lived outside the borough, and in 60 additional cases, owing to wrong addresses being given and to removals, no information could be obtained as to the subsequent history of the child. Deducting these cases, there remain 466 children of whom definite information was obtained. Of these, 394 were below, and 72 above one year old. The total number of deaths was 46.

The death rate amongst the children fed upon the milk was therefore 98·7. This rate cannot, however, be compared with the infantile mortality in the borough, *i.e.*, the number of deaths under one year per 1,000 births, as 72 of the depot fed children were above one year old. On deducting these children, there remain 394 infants under one year, of whom 39 died. This is equivalent to a rate of 98·9 per 1,000, which compares favourably with the infantile mortality in the borough, which was in the six months July to December, 1902, 143 per 1,000 births. This comparison, however, does scant justice to the depot. The borough includes the South-Western sub-district where the infantile mortality is low, whereas the depot children were nearly all drawn from East and North-West Battersea, where it is high. In the following table no account is taken of the children from South-West Battersea:—

Number of Infants attending the Depot from East and North-West Battersea. July—December, 1902.	Deaths.	Death-rate per 1,000.	Number of Deaths under One Year in East and North-West Battersea. July—December, 1902.	Mortality per 1,000 Births.
363	36	99·1	315	163·5

But even this comparison is not fair to the depot. A large number of the children attending were already seriously ill on admission, and some of these died before the milk had had a fair trial. Of the 39 infants under one year fed from the depot who died, no fewer than 14 had taken the milk

for less than one week. A fairer comparision is to deduct these deaths, and to deduct also from the deaths in the borough, and in the sub-districts, the deaths occurring in the first seven days of life. When this is done the following results are obtained :—

Death-rate per 1,000 of Depot-fed Infants, excluding deaths of Infants taking the milk for less than 1 week.		Infantile Mortality per 1,000 Births, excluding deaths of Infants under 7 days old.	
Death-rate of Infants attending from the whole Borough.	Death-rate of Infants attending from East and North-West Battersea.	Mortality in whole Borough.	Mortality in East and North-West Battersea.
63·4	68·8	118·9	139·7

From these figures it appears that the mortality of infants in Battersea during the last six months of 1902 was 87·5 per cent. higher than the mortality in the depot-fed children, and that taking the mortality in East and North-West Battersea only, the difference is no less than 103 per cent.

It may be argued that the above comparison is fallacious, on the ground that the mothers of the children attending the depot may be assumed to be more intelligent and alive to the children's welfare than the average mother, and that in any case these children would have had a better chance of survival. There is an element of truth in the contention, but that this influence is more than counteracted is apparent, in my opinion, from the following considerations :—

1. By far the greater number of children attending the depot were in a state of ill-health on admission, and many were already seriously ill. The milk is in many cases regarded more as a medicine than as a food, and when the baby has recovered from the illness which brought it to the depot the milk is often discontinued, and the usual condensed milk diet is resumed. The depot death-rate should, therefore, be regarded as somewhat analogous to a dispensary death-rate. Moreover, the milk is not infrequently misused, being poured from the sterilised bottle into the ordinary lethal bottle with the long rubber tube.

2. Most of the depot infants were under six months old, whereas the majority of the infants outside would be aged between six and twelve months. This is an important point, as the mortality is always much greater in the first period than in the latter; in fact, no less than 50 per cent. of the infant deaths occur in the first three months. If the ages of the depot infants and those outside were the same, the figures would be still more favourable to the former.

3. The depot children are all artificially fed, whilst a considerable

number of those outside are fed from the breast. It is not claimed that the Council's milk is anything but a poor substitute for human milk. No artificial food can be, or probably ever will be, anything else. The depot children should be compared with children outside who are fed artificially, but figures for this comparison are not available.

4. An unusual proportion of the depot children are illegitimate, and the mortality amongst such children is always higher than in legitimate children. Battersea contains more houses registered under the Infant Life Protection Act than any other borough in London, and a large number of these "nurse children" are fed on the Council's milk.

From these considerations I cannot regard the depot-fed children as constituting a favourably selected class. I think that the contrary is probably the truth.

The figures I have quoted afford, in my opinion, substantial evidence of the value of these institutions; and evidence of as great, or even greater weight is to be found in the testimony of medical practitioners who have prescribed the milk. The testimony, in Battersea at all events, is almost universally favourable, the doctors who have had most experience of the milk being most enthusiastic in its praise.

I think we may be assured that the municipal infants' milk depot is an institution that has come to stay; and I would conclude this paper by expressing a hope, which I am sure this meeting will share, that the depot lately started in this city will meet with the success which has hitherto attended the Bradford municipal institutions.

Ald. A. M. Stevens (Vice-Chairman of the Norwich Health Committee) said that he rose purely in the spirit of inquiry, because the matter of milk-supply was one of very considerable interest to his Corporation, for Norwich was in the unenviable position of being very highly rated in the matter of infant-mortality, and therefore the milk-supply question had been brought prominently under their notice. A sub-committee had been appointed and had visited the municipal milk-depôts at Liverpool, Battersea, and elsewhere. Their feeling was that it was an admirable idea, but its advantages were only obtainable by the section of the community which least needed it; that the advantages of the institution were beyond the reach of the very poor because the cost of the milk was beyond their means. After that the committee pressed for further consideration of the matter, and, therefore, they invited to their aid at a Conference the medical gentlemen of the city. Then they found that the discussion took another form,

and it appeared that the sterilised milk was open to another objection which he, as a layman, had been unprepared for. They were told that sterilised milk, if continuously given, instead of being a benefit was the contrary, and might lead to various complaints such as rickets and other things. The medical gentlemen there in the majority decided against sterilised milk; but the sub-committee, after reporting this to the committee, ventured upon a further consideration of the matter, and invited to another Conference the gentlemen most interested in the supply of fresh milk, so as to enquire whether, in regard to the supply of fresh milk, there were conditions which might be improved upon, so that they might look with more confidence in the future to that source rather than go in for a municipal supply of the sterilised milk. As a result of that meeting some very practical suggestions were made. One of the suggestions made was that instead of a person obtaining a right to supply milk simply by making notification to the sanitary authorities, as at present, the municipal authorities should try and obtain the right of issuing certificates for the supply of milk, so that it should be a matter of obtaining permission instead of merely making notification, and that then better regulations could be imposed. He did not want to bring his city into unfavourable notoriety, but they found in common with the experience of other places, that there was a good deal in the treatment of milk, and that the milk did not find its way to the consumer in the pure condition which ought to be maintained, and they had come to the conclusion that if means could be obtained of securing a purer supply of the fresh milk, that would go a long way towards doing away with the evils from which the children were at present suffering through want of pure milk.

Bailie W. F. Anderson (Chairman of the Glasgow Health Committee) said that it was a standing disgrace to sanitarians that, whilst progress had been made in every other direction, in the matter of infantile mortality we had been standing still, if not even going backwards. He had taken the opportunity of visiting the Bradford Depot, and had been delighted with what he saw there, and had been the more ready to go there because some two or three months ago his council had sent a deputation to Liverpool and Battersea in order to learn something about this matter on the spot. Whilst he stood in the Bradford Municipal Milk Depot he was delighted to see women who were then coming for the first time and getting the necessary information. Whilst the Bradford Depot had not been established long enough to enable its managers to point definitely to statistics it was evident that there must be a considerable improvement in consequence of its work, especially when they considered the fact that many of the people who brought their children there brought them practically as they would bring them to a hospital, when they were almost at the very door of death, and as a last resource after their digestive organs had been almost totally destroyed. He saw a case recently, in London,

in which an inquiry was held over the death of a child and the mother had expressed her astonishment that it had died because, she said, it had had everything that was going in the house. That child was under 12 months of age. There was a great amount of wrong idea as to the up-bringing of children and that could only be dissipated by education. At the municipal milk-depot the milk was already prepared upon scientific principles and little was left to the mother, and that ought to make a tremendous difference to the infantile mortality. He had heard the question of fresh cows' milk versus sterilized milk discussed upon the result of a test in which the children on one side of a hospital ward were fed upon sterilized milk and those on the other side were fed upon fresh milk, and the results were said to be very much to the advantage of the children fed on the fresh milk; but could they tell him how it was possible to keep milk well in ordinary houses where the temperature was usually stifling, unless they kept it in sealed vessels. And it was so difficult to make sure that precautions were taken with the milk when it was used in the ordinary feeding-bottles. He heard at Liverpool that they had made some experiments upon kittens with the dregs of babies' feeding-bottles, with the result that one set of kittens were purged to death in no time, whilst another set, fed on sterilized milk, throve splendidly. There was a great difficulty in keeping the bottles clean. He had known even a trained nurse, after giving a baby the bottle, put it down beside her without rinsing it out or cleaning it in any way, and then, when the baby next wanted a drink, there was no time to wash it, and the bottle was used just in the state in which it was put down. By this new system the milk was supplied in the first instance in air-tight bottles, and could be kept for at least a week without taking any harm. In Liverpool he was told that they gave enough for 63 feeds for 1s. 3d. at first, but recently the price had been raised a little. He hoped, however, that that Congress would never allow a question of pounds, shillings and pence to stand in the way of measures for the reduction of infant mortality. The authorities, who expended money without hope of financial profit upon parks, art galleries, bands and other things of the sort, could surely afford even to lose a little money, if necessary, in the effort to remove the stigma which was resting upon them in regard to infantile mortality. By all means let the sterilized milk go into every dairy in the city if they could get it there, and give the dairyman his full chance of a fair profit on selling the prepared milk just as he had on the fresh milk; but do not allow him or any other private trader to sterilize or humanize the milk on his own responsibility, because if they did that they placed the reputation of this product in the hands of people who were servants, and they might entirely spoil their experiment. His suggestion was that local authorities should do the humanizing and sterilizing themselves, and supply the milk so dealt with in stoppered bottles, giving the dairyman to whom they distributed these bottles to understand that they were not hostile to them, but wished to have their co-operation, and that their profit on the distribution of the prepared milk would be as good as that on the ordinary milk. In

Glasgow they had a very large staff, close upon 90 male and female inspectors, and he did not think there was any city in the kingdom where there was a better supply of fresh milk, because the authorities were very severe upon offenders; but he felt that in a city which had a general death-rate of only 17, and that a declining rate, and yet lost from 143 to 160 per thousand of its children, it was high time that they made some effort to improve that state of affairs, and it was worth a good deal of money to remove such a stigma. He hoped that the congress would enthusiastically endorse the action of the corporations who had undertaken the municipal milk-supply, and that the municipal representatives present would go back to their own localities convinced that they might experiment with some profit in this way in the direction of saving young life.

Dr. A. K. Chalmers (Medical Officer of Health, Glasgow) said the infantile death-rate in this country was a standing reproach to sanitation. The matter was now so pressing that one got almost hypercritical at any suggestion made with a view of alleviating it; hypercritical in this sense, that one was tempted to ask whether they were going on lines that were likely to reduce the infantile death-rate, or were wasting their energies in hunting a fetish. Whilst Dr. McCleary had dealt in a most interesting way with the proportions of deaths among children who were being fed upon sterilized milk, there was one aspect of the death-rate of infants which they must take into account; Dr. McCleary had said that one third of the children who died under one year of age died under one month. That was true of Battersea, no doubt, and was true of the country generally; but he thought he had the acquiescence of every doctor present in the statement that deaths of children under one month did not generally occur from disease at all; not from disease caused by external surroundings, but from congenital conditions and imperfect development, conditions which could only be dealt with by feeding the mothers. It was the maternal condition before birth which pre-emininently caused the deaths of children under one month; and that, therefore, accounted, as they knew, for no less than 33 per cent. of the total deaths under one year. Therefore, when Dr. McCleary approached the question of statistics of deaths among children he should compare the deaths at given months among the children who consumed sterilized milk with the deaths at similar months among the general population. That was the only way in which they could arrive at the true conception of the saving of life which resulted from the use of sterilized milk. Bailie Anderson had raised an extremely interesting point when he said he believed that the pollution of fresh milk occurred very largely in the houses where it was used. It was still an open question, indeed, whether they should regard the beneficial results which were ascribed to the humanised milk as being due to the sterilization merely, or due to the fact that the milk in that form was protected from contamination after it entered the houses. They knew that the custom in an ordinary household was to leave milk

quite exposed, and that that was one of the most frequent sources of infection. The question was whether, if they sold fresh milk in covered and sealed vessels which were not opened until the milk was to be consumed, they would not have as good results as were ascribed to sterilization; that was, whether the protection of the milk was not a more important matter really than the sterilization. Another question of interest was why they should regard the proportion of fat in milk as being the only test, and why they should not also have a bacterial standard of milk. They had accumulating evidence that the contamination of milk which took place between the stage at which it reached the buyer, and the time of consumption, was a rapidly increasing quantity. When a certain proportion of bacteria were present undoubtedly the milk was potential for mischief, whilst with a smaller proportion it would be quite innocuous. Why not, therefore, make the Food and Drugs Act apply to bacterial conditions. He was not antagonistic to Dr. McCleary's paper, but he felt strongly that the matter was very urgent, and that they must walk warily and not spend their energies until they were thoroughly satisfied that any step which they might propose to take would really result in what they hoped to accomplish.

Dr. Philip Boobbyer (Nottingham) said he entirely agreed with the previous speaker as to the urgency and importance of the question. The steady maintenance of the infantile death-rate among the poor was the only fact that need be cited to justify this view, but the concurrent decline of the birth-rate added a disquieting significance which all but the most pessimistic Malthusian must deplore. The false modesty and reticence of average people with this last subject were, he thought, in themselves sufficient indication that the general use of artificial means for the prevention of conception was fully recognized. The decline of the birth-rate was indeed a matter of national importance. But serious as was the state of things in this country, it was considerably worse in France and parts of America and of our own Colonies, especially Australia. People were apt to lose sight of the fact that one of the necessary results of a declining birth-rate was an increasing death-rate at no very distant date, as the age-constitution of the population began to shift upwards. With a rising generation that was ever dwindling for lack of fresh blood, it behoved them more and more to do all in their power to preserve the young brood. In his own town (Nottingham), Dr. Boobbyer said, the infantile death-rate (per 1,000 born annually) varied from about 150 to 210, according to the prevalence of epidemic diarrhœa, and as a preliminary step in endeavouring to cope with the mischief, he had issued, some thirteen years ago, an infant-feeding-leaflet, giving simple instruction respecting the feeding and care of infants. There was nothing new in this leaflet. It was only an orthodox guide in plain English to the rearing of infants upon milk and other food artificially prepared. Copies of the leaflet were distributed by officers of the Health Department (Inspectors and Lady Visitors), by District Registrars of Births, and any other people who would undertake the duty. The

need of such instruction among the poor was too self-evident to call for further comment. His artificial food consisted of boiled cows' milk, diluted and sweetened in the earlier stages, and strengthened and enriched with cream later on when the infant digestion would bear it. He had notes of eighteen children brought up by hand more or less strictly according to this regimen; all had done well. There had been no sign in any of them of the fulfilment of Dr. Vivian Poore's sinister prophecy* with regard to the probable effect of the feeding of children upon boiled milk. Once the child became accustomed to its cooked milk it did wonderfully well upon the artificial diet. It was difficult indeed to see the essential difference between the cooking of milk and rump steak. Without entering into a discussion on dietetics, we had the same elements in a slightly modified form when cooked, and the food was infinitely safer than when taken raw. It was better, of course for the child to be fed upon suitable and healthy human milk from the breast, but if this were not readily obtainable, modified cows' milk forms an excellent and entirely suitable substitute. Half the battle of the hand-feeding of infants was the sterilization of the milk immediately before ingestion. It was as hard to convince the ignorant of the meaning and necessity of sterilization in infant-feeding as of the value of fresh air for all of us. Very dangerous leaders of the blind, too, were some nurses. They frequently failed to understand the meaning of the formulas they had learned. They appeared to have them only by rote. Absolutely essential to safety was the cleanliness of the feeding bottle. Yet nurses would often leave it lying about when not in use, altogether regardless, ignorant or reckless, of the risk of such exposure. According to his instructions, Dr. Boobbyer said, the bottle was not laid down at all. It was washed in boric acid solution directly after use, and then kept steeped in similar liquid until required again. Nurses were reminded that the baby's natural food came to it directly from the mother's secreting organ as pure living-matter, and that the sterilising apparatus was intended to take the place of the mother's organ in yielding the milk in a pure state directly to the mouth of the child.

Councillor F. W. Jowett (Bradford) said it seemed to him that Mr. Stephens had rather confused two separate things: the provision of humanised milk for children, and the provision of ordinary milk for adults. So far as the provision of pure milk for adults for ordinary consumption was concerned, he should quite agree that it was not necessary that sterilised milk should be purveyed if they could get a pure milk-supply. The first requisite for the ordinary milk-supply would be the provision of pure milk, the cows being examined and certified to be free from tuberculosis or any other objectionable thing. After that the milk should be filtered, in order to free it from any impurities which might have been added to it after it had been taken away from the pail; and the

* Soil in Relation to Contagia.

third thing, which seemed to him to be very desirable for ordinary milk-supply, was that it should be kept chilled, so that any bacteria would not grow—not that they should be killed after they had grown, but that they should not be allowed to grow, by the fact of the milk being kept chilled all the time until delivery was made. As to the humanised milk for infants, he thought there could be no doubt whatever that it was necessary that public bodies should take some interest in the provision of milk treated in the way which had been indicated by various speakers.

ALDERMAN IMRIE (South Shields) said he had long felt, as chairman of a Health Committee, that the amount of infantile mortality was a burning shame on all of them. The paper which had been read had answered to a large extent the problems which had been in their minds. Perhaps the cream of the paper, however, lay in the sentence, "It is not claimed that the Council's milk is anything but a poor substitute for human milk," and the thought had crossed his mind as to what kind of human milk it was that the comparison referred to. Were there not other ways by which they could travel to attain the same end? He could only hint at what he was thinking about. What diseases did children die of? Were they getting classified lists of the diseases from which the children died? He was told by a medical man that in the vast majority of certificates the death of children was ascribed to debility, which might mean any of a great many things, or might mean next to nothing at all. The certificate of death was given by the medical attendant to the parents. Why should it not be sent direct to the Registrar-General? Why should the medical man be continually put upon his honour in that way in regard to the giving of these certificates? He felt that this condition of things had a good deal to do with the problem that they were discussing, and if they could overcome the disadvantages arising from the system of certification of the causes of death, they would be going a long way in the direction of reducing infantile mortality.

DR. COOPER PATTIN (Norwich) said there was a very high rate of infantile mortality in Norwich, and 20 per cent. of the deaths of children under one year were due to premature birth. That was so according to the formal certificates. In point of fact, the deaths due to that cause were over 20 per cent. The question of the milk-supply had occupied the attention of his committee for some time. Of all the experiments with the supply of sterilised milk which he had examined he should certainly recommend his council to adopt the Battersea system, but it was important that before they adopted any system they should get some clear and authoritative statement as to the effects of continuous feeding with sterilised milk. When the Norwich Council called the members of the medical profession together, one of these gave particular instances in his own family of the effects of feeding with sterilised milk which were to the very

opposite effect to those which Dr. Boobbyer had brought forward in regard to his family, and the testimony to which he alluded had a very pronounced effect upon the meeting. Somewhat to his surprise the majority of the medical men gave opinions unfavourable to continuous feeding with sterilised milk, and the opinion which had carried most weight with the committee was that of the one gentleman who said that in his own family it had seriously interfered with the health of one of his own children; and he ascribed that result entirely to this system of feeding. In face of statements like that it was felt that the Health Committee could not advise the council to adopt a supply of sterilised milk; but after that meeting they had another, and it appeared to him that what came out quite clearly was the great importance of the milk being protected from contamination, and what he should like to see was a really good class milk, reduced to a lower temperature, and supplied in the same way as the sterilised milk was, namely, in sealed bottles. An experiment might be tried, extending over a long period of time, on children fed on sterilised milk, and others fed on ordinary milk under the conditions which he had suggested; and he thought that if that were done it would be found in a large number of instances that the protection of the milk from contamination was more important than the sterilisation. Of course he was well aware how practically impossible it was to get the admirable directions that were given carried out. At the meeting of the Norwich medical men a proposition was brought forward to establish what was virtually a milk clearing house in the city; that all the milk to be sold in the city should be sent to a municipal establishment, standardised there and distributed from there, not by the Corporation, but by the milksellers; that the Corporation should make itself responsible for the milk being of a definite quality in regard to the wholesale supply. But it seemed to him that if the Corporation tackled the milk-supply at all, the practical outcome of that development would be that it would ultimately have to take control of it. The standardising of the milk-supply had already been done in New York and was a success. He was told that milk had been sent to the Paris Exhibition which had been subjected to bacterial standardising, and kept in the low temperature of cold storage whilst crossing the Atlantic, and had then gained the gold medal against all other milks. It seemed to him that it was quite possible that that should be so. The all-important question seemed to be whether the influence which some attributed to sterilisation was not very largely due to the admirable manner in which the milk was distributed, and whether they would not obtain from perfectly good fresh milk, subjected to bacterial standardisation and kept at a low temperature and in hermetically sealed vessels, even better results than were obtained from the sterilised milk.

Mr. Jacob Moser (Bradford) said that it seemed very certain to those who had looked into the matter that a great deal of the infantile mortality was due to the want of knowledge on the part of mothers as to how to feed the children,

and he thought a great deal could be done, and ought to be done, in every district in the way of instructing the mothers who were wanting in this knowledge.

Dr. McCleary (Battersea), in replying upon the discussion, said it was hardly correct to state, as the Chairman of the Norwich Health Committee had stated, that the humanised milk did not reach the very poor. It was true that at Battersea they charged sums varying from 1s. 6d. to 2s. a week, but they made an arrangement with the Board of Guardians whereby the relieving officers had power to issue orders on the depot instead of giving money which the woman could spend at the public house. The various charitable institutions also gave orders in this way, so that they did, in point of fact, touch the very poorest. But it was not necessarily the case that those who would most profit by the system were the very poorest, because there were large numbers of the very poor who did not feed their children artificially. The poor Irish and Jewish mothers generally fed their children from the breast. So far as his experience went the children who most wanted humanised milk were not the very poor, but those whose mothers went out to work and earned wages, and left their children in the custody of ignorant nurses. There were, too, a large number of illegitimate children in the care of these nurses. A common arrangement was for the mother to pay 5s. a week per child, and the nurse paid 1s. 6d. or 2s. a week for the milk, and was very glad to be able to get it. In answer to Dr. Chalmers he would remind them that not only was it a fact that a great percentage of the deaths occurred under one month, but that also a great many occurred in the first week. Most of the deaths from congenital defects occurred in the first week, and in his paper he had dealt with that point, because in the last table he had excluded those who died under seven days. But he agreed that a more valuable statistical statement would be obtained by setting out the respective death-rates in periods of months. He did not wish to suggest for a moment that the use of humanised milk was the only way of dealing with infant-mortality. It had been suggested that in the schools, systematic instruction should be given in infant-feeding and the rearing of the young, and there could be no doubt that that would be a most excellent thing. He also quite agreed with all that had been said as to the importance of securing pure supplies of fresh milk, by improving the condition of cowsheds, insisting on the careful grooming of the cows, and so on, but it would be very difficult to ensure that all these measures were carried out, especially in London, where they had few cowsheds and got nearly all milk from the country. He thought that the milking of cows should be carried out with rigorous aseptic precautions. If, however, they brought absolutely pure milk into the house they would not solve the problem, because they would not be dealing with the question of home-contamination, and Dr. Newsholme had shown that the larger part of the infantile diarrhœa mortality was due to home-contamination. The point about

the alleged harmful effects of children being fed for long periods on sterilized milk was of course a serious one. He had looked for such effects and could not find them. He had examined children who had been fed on the milk for six months and could not find such effects. He did not say that sterilized milk was the best thing to give to children, but it was certainly a good deal better to give them that than to give them condensed milk and proprietary foods, which undoubtedly caused rickets and scurvy. The most perfect food, of course, was the mother's milk. In conclusion he moved the following resolution: "That this Conference is of opinion that the high death rate of infants urgently calls for a special inquiry, and would recommend the Institute to appoint a special committee on the subject."

Alderman Hindmarsh seconded the resolution, and after some discussion it was put and carried, and it was decided to send it up to the Council, although notice had not been given in the proper form.

Note.—Resolutions passed at Meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 855.

SUGGESTED AMENDMENTS TO PART II. OF THE HOUSING OF THE WORKING CLASSES ACT, 1890.

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(Fellow.)

THE Housing of the Working Classes Act, 1890, is probably the most important Sanitary Act which has been passed since the Public Health Act, 1875, in that the application of the several parts into which it is divided has done more to improve the dwellings and surroundings of the labouring classes, and even of the poor, than any other sanitary enactment.

The Act, as is well known, is divided into three chief parts, viz., Part I., only applicable to urban districts and dealing with unhealthy areas by means of an improvement scheme; Part II., which applies to both urban and rural districts, and enables sanitary authorities to proceed against the owners of one or more houses which are so dangerous or injurious to the health of the occupants as to be unfit for habitation, and also to deal with obstructive buildings and small groups of dwellings by means of an important scheme; and Part III., which enables a sanitary authority to provide houses for the working classes when and where such may be necessary.

I do not propose in this short paper to refer to the administration of Part I. for the delays, difficulties and great expense invariably incurred by sanitary authorities who have exercised their powers under it respecting unhealthy areas have been discussed on many occasions, and I believe at some of the Congresses of this Institute. Suffice it to say that the experience of some of our large towns, in their endeavour to deal with insanitary areas under Part I., has been an effectual damper to other towns in which large areas of dilapidated unhealthy dwellings can only be effectually dealt with by an improvement-scheme, and that it is generally

admitted that Part I. of the Act requires to be amended so that the procedure may be simpler, the delays less vexatious, and the expense to the ratepayers greatly diminished.

Neither do I intend to refer to Part III. of the Act, which is adoptive and in rural districts can only become operative with the consent of the County Council, for this part also has been the subject of many valuable papers and discussions during recent years, especially with respect to the necessity of increasing the period of repayment of loans sanctioned to sanitary authorities for the provision of working-class dwellings. I may state, however, that the procedure of this part of the Act, especially as regards rural districts, has been amended and greatly improved by the Housing of the Working Classes Act, 1900, but greater facilities require to be granted to sanitary authorities to enable them to provide cheap and healthy houses on convenient sites for the inhabitants of overcrowded districts.

It is safe to say that the application of the provisions of Part II. has been far more general and frequent than any other part of the Act, and has been productive of most good.

Prior to the passing of the 1890 Act, proceedings for the closing of dwellings unfit for habitation had to be taken under the nuisances sections of the Public Health Acts, 1875, or the Housing of the Working Classes Act, 1885, and under both these Acts there were many difficulties to be overcome before an insanitary house could be closed. By proceeding under Part II. of the Act of 1890, there is much less difficulty in obtaining a closing order in respect to a dwelling unfit for habitation, but ten years administration of this part of the Act by the Durham County Council has revealed serious defects which in some cases cause great hardships, and may even prevent the enforcement of a closing order granted by the Justices. For the last ten years the Durham County Council has exercised its powers under Section 45 (2) of the Act, and has dealt with nearly 2,000 insanitary dwellings. By that section a County Council has power in rural districts to call upon the Sanitary Authority to institute proceedings under the Act to close dwellings which, in the opinion of the County Council are unfit for habitation, and, if after reasonable notice, not less than one month, the County Council is of opinion that the District Council has failed to institute and properly prosecute proceedings either as regards the closing or demolition of an insanitary dwelling, or the pulling down of an obstructive building, the County Council may pass a resolution to that effect, and thereupon the powers of the District Council as respects the said dwelling-house or

obstructive building under this part of the Act (otherwise than in respect to a scheme) shall be vested in the County Council, and if a closing order or an order for demolition, or for pulling down an obstructive building is made, and not disallowed on appeal, the expenses of the Council as respects the said dwelling-house, including any compensation paid, shall be recoverable by the County Council from the District Council. In a considerable proportion of the houses scheduled by the Durham County Council as unfit for habitation, the County Council has had to exercise the powers of the Rural District Councils by default, and I will shortly refer to some of the most serious difficulties encountered by the County Council in administering the Act, difficulties which for the most part it must be remembered have also to be met by district authorities who desire to close insanitary dwellings.

In the first place the definition of the word "owner" in the Act is unsatisfactory, for notices must be served and proceedings taken against either the owner, as defined in the Land Clauses Acts, or against the persons holding the property on a lease or mortgage for a term of years of which at least twenty-one years have still to run. Proceedings cannot be instituted against the agent of the owner as is permitted by the Public Health Act, 1875, and it is often a very great hardship on the actual owner, who has, perhaps, let the premises on a repairing lease for a long term of years and may, therefore, not be responsible for the property falling into an insanitary state, to be called to put the property into repair or close it, because something less than twenty-one years of the lease has yet to run.

The difficulty as regards the word "owner" would be overcome if the word had, in addition, the same meaning as in the Public Health Act, 1875.

Another and much more serious defect in the Act is that when once a closing order has been obtained no further responsibility rests on the owner as to the closing of the dwelling, all subsequent proceedings to that end being directed against the tenants. The tenant must receive not less than seven days' notice from the prosecuting authority to vacate the house, and if he makes default in obeying the notice he is liable to a penalty of 20s. a day during the time he continues to occupy the house. This method of procedure often inflicts the greatest hardships on the tenant, who is usually not to blame for the insanitary condition of the dwelling, especially in overcrowded districts, where it is often impossible for him to find another house. The Justices making the order have power to grant a reasonable allowance, recoverable from the owner, to

the tenant on account of his expenses in moving, but in most districts the Justices refuse to make any such allowance or to impose any fine on the owner for being in possession of insanitary property.

In practice it is often impossible for the prosecuting authority to get the tenant out of the house after a closing order has been obtained, for the penalties resulting from the tenant disobeying the order to quit can only be recovered by distraint, and very frequently the personal effects are not worth distraining upon. Besides which many authorities are averse from taking extreme measures against tenants who have committed no offence, and to whom eviction frequently means loss of employment as well as house, owing to the impossibility of their obtaining another house in the neighbourhood of their place of employment.

The difficulty of getting rid of the tenants is, of course, much greater where a number of houses are ordered to be closed, especially in overcrowded districts like most of the mining districts of Durham, where it is the custom for the employers to provide free houses for their workmen, and where, owing to the uncertain life of the collieries or works, the erection of dwellings by private enterprise is practically *nil.* In such cases the closing of insanitary dwellings (and I regret to say that there are still many houses not fit for habitation in the county) would invariably mean overcrowding of other houses in the district, while apart from that, the difficulties in the way of the prosecuting authority evicting the tenants very frequently renders the effective administration of the Act impossible. The only remedy I can suggest is that the duty of removing the tenants from houses ordered by the Justices to be closed should be placed on the owner, who should be liable to a penalty for each day a house continues to be occupied after a date fixed by the Justices making the closing order.

It is certain that if this were done owners would take more care to keep their houses in a sanitary condition, and in the county of Durham, where it is the custom for the colliery-owners to provide houses for their workmen, it would impress on some owners the necessity of replacing by modern dwellings houses which nothing short of reconstruction can make sanitary.

Another amendment of the Act which, in my opinion, is very desirable is the extension of the powers of County Councils under Section 45 (2) of the Act to urban districts, other than boroughs. It is an undoubted fact that in many of the smaller urban districts there is less inclination on the part of the sanitary authorities to enforce their powers respecting houses unfit for habitation than in rural districts, owing to the fact, probably, that

members of the Council are elected from a more restricted area, and consequently have more common interests, and moreover are themselves not infrequently interested in small house-property. In such districts much good would result if the County Councils had power to deal with insanitary dwellings respecting which the Urban District Councils had made default in enforcing their powers under the Housing of the Working Classes Act.

It is also very desirable that a sanitary authority should have power to appeal to Quarter Sessions when the application for a closing order has been refused by the Justices. At present the owner is able to appeal against the order of the magistrates closing his house, but the prosecuting authority has no appeal against an adverse decision which may be capricious and against the weight of evidence. In two instances where applications for closing orders by the Durham County Council were dismissed by the Justices, there were strong reasons for believing that the decisions, in the face of the strongest evidence as to the insanitary condition of the dwellings, were affected, in one case by private opinions formed without hearing the evidence, and in the other by local influences.

From the point of view of County Councils, it is important that the Act of 1890 should be amended by the introduction of a section which will prevent a closing order obtained at the instance of a County Council from being rescinded by the Justices unless due notice has been given to the County Council of the application for such rescission. On more than one occasion, as a result of a certificate being given by a Rural District Council, the Justices have rescinded closing orders obtained by or at the instance of the Durham County Council without the latter's knowledge, and the houses have subsequently been re-occupied, although in the opinion of the County Council they have not been made properly fit for habitation. It is only reasonable that, if the County Council has been instrumental in obtaining the closing order, information should be given to that authority of any application for the rescinding of that order.

Power should also be given to sanitary authorities to obtain the demolition of a house permanently closed as unfit for habitation, if its removal is desirable, even though it may not be proved to be dangerous or injurious to the health of the public or of neighbouring tenants.

A house which has been permanently closed is unsightly and undesirable, it frequently obstructs light and air, and in other ways may be objectionable.

The only other point to which I want to call attention has reference to the forms of notices required to be used, and which are set out in Schedules iii. and iv. of the Act.

Under Schedule iii. the form of notice and procedure is laid down in the Public Health Act, 1875, respecting nuisances injurious to health, and the notice must specify the works necessary to abate the nuisance; while under Form A of Schedule iv., the notice must call upon the owner to make the dwelling fit for habitation, even though it cannot be made habitable, and it is the intention of the sanitary authority to permanently close it. As a result of such a notice the owner not infrequently spends money in a useless endeavour to comply with its requirements, and it is very desirable that Schedule iii. should be amended to enable the sanitary authority to apply for a closing order, when the premises are so dangerous or injurious to health as to be unfit for habitation, and are incapable of being made habitable, without the necessity of calling on the owners to make them habitable.

If that were done Form A of Schedule iv., might be used with respect to premises which could be made habitable, and the notice in such cases should state the work required to be carried out to make the premises habitable.

On several occasions the Durham County Council has drawn the attention of the Local Government Board to the necessity of amending Part II. of the Housing of the Working Classes Act, 1890; and the President of the Local Government Board having stated during the present session of Parliament that he proposes to introduce a Bill to amend the Housing of the Working Classes Acts, the County Council in May last forwarded to the Local Government Board and the County Councils Association the following suggestions prepared by the Clerk and myself for the amendment of the Acts:—

1. To make the meaning of the word "owner" the same as in the Public Health Act, 1875.

2. To make the owner of a dwelling-house as to which a closing order has been obtained liable to continuing penalties as long as he permits it to be occupied.

3. To provide that no closing order shall be determined without notice to the Council of the Administrative County in which the dwelling is situated.

4. To give power to Sanitary Authorities to make a demolition order as to any building which is dangerous or injurious to the health of its own inhabitants.

5. To give County Councils power to enforce the Act in urban districts other than Municipal Boroughs.

6. To give a right of appeal against the dismissal of an application for a closing order.

The necessity of some, if not all, of the above amendments, having regard to effective administration of Part II. of the Act of 1890, is I think evident; and the probability of some of them being introduced into any amending Government Bill, would be greatly enhanced if the action of the Durham County Council were supported by the powerful influence of The Sanitary Institute acting on the recommendation of this important Conference.

Mr. Samuel Adams (Clerk to the Rural District Council of Auckland) said he cordially agreed with the first two of Dr. Hill's suggestions for amendment of the Act. The first would help very materially in serving notices and getting the Act into operation, and the second would make it much easier to get an order of the justices carried out. But he thought that the other four suggestions were open to very considerable objection. It was evident that the paper had been written from the point of view of the county councils. It was not well to have the county council continually interfering with the action of district councils, as was sometimes the case. The district councils, as it was, had frequently cause of complaint of being overridden in their decisions by the county councils. The representatives of district councils were very much better able than the representatives of county councils covering a large area to determine what was best for their own districts, and there could be no advantage in their being subject to the dictation of the county councils in such matters. Dr. Hill said that the result of the service of the notice on an owner frequently was that he spent money in a useless endeavour to comply with the requirements of the district council. A case which would well illustrate that point had occurred at a meeting of his council the day before. A house was reported as being unfit for habitation, and the council had to serve notice for the necessary work to be done to make it habitable. The notice ordered to be served was one stating that the height of the rooms must be raised to ten feet, that through ventilation and proper drainage should be provided, a new roof should be put on, and that the present privy and ashpit should be removed and new ones built. A member of the council asked whether it did not amount to the building of a new house, and of course it did. If the notice were not complied with, and a new house built, the house would be closed. Therefore he did not see any need for the suggested alteration of the law in regard to the strict operation of a closing order after the service of a notice to put the house into a habitable condition. They gave the owner the opportunity of putting the house into proper repair. If he complied with the notice, well and good; if he failed to comply, a closing order would be obtained. With regard to the rescinding by justices of closing orders when

notices to repair had been complied with, they would notice that Dr. Hill said, "On more than one occasion, as the result of a certificate being given by a rural district council, the Justices rescinded closing orders obtained by, or at the instance of, the Durham County Council without the latter's knowledge," and the suggestion was that before any action was taken for the rescinding of an order by the justices notice should be given to the county council of intention to apply. People on the spot who knew the circumstances and knew what was necessary, might be quite satisfied that the house to which the closing order related had been put into a proper condition, but it was not enough. The county council was to receive notice, and then that body would instruct their solicitor to make a journey to the petty sessional division where the house was situated, and the solicitor would go there, not necessarily to oppose, but to hear what was going on. A bill would afterwards come in to the district council for £5 or £6 as the solicitor's fee and expenses. And perhaps the medical officer would go, and the clerk to the county council also, and a bill would come in to the district council in proportionate amount for their special services and expenses. It would be a means of running up costs against a district council which certainly ought to be avoided, for it was not at all a necessary step to take. The fourth suggestion made by Dr. Hill was a most serious thing for the district councils. With the press of business they now had they could not possibly find time to carefully consider the question of the demolition of buildings, and he did not think that that was a power which should be conferred upon them. Such a question should go before a judicial tribunal, and be argued out by representatives of both sides. In dealing with matters of this kind district councils were necessarily largely guided by reports from their officials, and this suggestion practically put these officials in a position which ought only to be occupied by a judicial bench. His principal objection, however, was to the control of the county council in these matters. That was absolutely unnecessary.

Mr. John Lindsay (Glasgow) said that in Glasgow they had enforced the provisions of Part 2 of the Act, and they had not experienced the difficulties which seemed to have beset the operation of the Act in some other parts of the country. He had noticed that one of the difficulties that Dr. Hill referred to was the restricted meaning of the word "owner." This was an imperial statute, applicable to Scotland as well as to England, but in Glasgow they had not had this difficulty, because in the definition Act they were referred back to the Public Health Act, and in the Scottish Public Health Act the word "owner," *inter alia*, included the person actually in receipt of the rent, and for the purposes of the Act they got at the factor and they regarded him as the owner. They got him on the spot, and so were relieved of the difficulty which arose in some cases of having to prove who the owners were. In many cases the owners were beneficiaries of old trust-estates, and they might be in all parts of the world. He did not, however, know whether the definition of "owner" in the English

Public Health Act was as broad as that in the Scottish Act. Another point of difficulty in England seemed to be in regard to the procedure which might be taken against the tenants for compelling them to leave a house after the closing order had been pronounced, and it did seem a little strange that the proceedings should be brought against the tenants alone and not against the owner. But in that matter also they had not the difficulty to contend with in Glasgow, because there was a provision, referred to in the paper, that any compensation which was to be payable to the tenant by the local authorities was recoverable by the local authorities from the owner, and not in any one of the cases that he had prosecuted had any difficulty arisen. And the reason was this, that the owner felt he was sufficiently punished by the closure in the first instance and the demolition afterwards of his property, without incurring any risk of recouping the local authority for compensation to the tenants. Therefore he arranged with his tenants to have them removed, if need be, by making an application to the Court for a summary ejectment of the tenant upon giving him notice some ten days, being a third of the period of his lease or tenancy, the tenants being in the majority of cases monthly tenants. But a point of greater surprise to him as to the practice of the Courts in England was the following sentences: "On more than one occasion, as a result of a certificate being given by a rural district council, the justices have rescinded a closing order obtained by, or at the instance of, the Durham County Council without the latter's knowledge, and the houses have subsequently been re-occupied." He could not understand that. He could not imagine that any Court, especially a Court of Appeal, as this Court practically was, would rescind any judgment of a prior court without intimation being given to the representatives of the local authority, and without their being heard. The practice in the city of Glasgow was where a nuisance existing in a house was such that the remedying of it could accomplish the desires and wishes of the local authority, then they simply took procedure under the Public Health Act with a view of having the state of matters complained of remedied. And in the event of failure to satisfy the order of the Court, there was a subsequent section which entitled him to ask the Court to prohibit the use of the dwelling-house until the order of the Court had been carried out. But if the state of matters in the house was such that no immediate remedy would meet the views of the local authority, then they had power, under a local act, on a certificate granted by the medical officer of health, the sanitary inspector, and the master of works (who was known in England as the borough surveyor), to take proceedings for the immediate closure of any such houses. The granting of that certificate raised a presumption against the house, and they gave notice to the owner to appear, not before a court of law, but before their committee of health, which was a committee delegated with powers from the corporation or local authority, and unless cause was shown to the contrary a closing order was pronounced, with the right of appeal within some five days to the Sheriff, whose position was somewhat like to that of the county court judge in England.

Under that power they had closed up hundreds of houses in the city of Glasgow. There was a provision by which afterwards, when the house had been put into order, the owner could come back to the committee of health and ask for the order being rescinded, and that was done in some instances; but otherwise the house remained closed, or was demolished, or its use was changed and the premises occupied for business purposes. Supplementary to that provision they obtained, in an Act of 1900 (a Building Regulations Act), powers whereby they could demolish these houses instead of under the earlier local Act, where proceedings had not been taken by the owner to have them rendered fit for human habitation, or where they continued to be a menace to the health of the people in the adjoining property. Further north they were very radical and drastic, and where they met a state of matters such as was described in the paper the remedy must be drastic and must be applied without any hesitation, and they were not usually guilty of any very great hesitation when such a state of matters was demonstrated to the committee. But if they were not satisfied even with all these methods of procedure, they proceeded under the Housing of the Working Classes Act. They had never availed themselves of Part I., because in that city they had local Acts, City Improvement Acts, which enabled them to deal with large areas. But as it had been represented to the Corporation by the medical officer that under that Act they should direct their attention to the matter of back lands, that was tenements reared up in what was originally intended to be the back court or yard of the front dwelling-houses, they had a special committee appointed to supervise all these back tenements in the city. They had selected cases where the hardship would be at the minimum, and taken all those properties, which were very numerous in Glasgow, where the back land was owned by the same proprietor as the front property; and when the owner argued it a case of hardship to demolish without compensation, as he invariably did, the answer was given that he was most to blame in this respect, that he had utilised as a site for another tenement what was intended primarily to be the back yard and breathing space of the front tenement, and in no one instance had his plea for sympathy and compensation been sustained. He did not say had not been sustained by the local authority, because from them the owner never looked for much sympathy, but the plea had never been sustained in a court of law. Under that procedure they were bound to go in the first instance to the Sheriff for a closing order, and then an order of demolition was pronounced by the local authority through its committee, with a right of appeal back again to the Sheriff. They selected these cases and got their certificates under Section 32, which said that the house was unfit for human habitation; and, having satisfied the Court upon that point, they served upon the owner a notice to put it in order. They knew that the condition of that house, and its situation and surroundings, were such that he could not carry out the requirements of that statutory notice; but that did not bother them at all, it rather assisted and influenced them in their

endeavour to get rid of these plague-spots in the back courts, and, having got their closing order, they pronounced the demolition-order, and though the owner appealed to the Sheriff, they proved the two points which were required for the successful operation of Sections 32, 33, and 34: firstly, that the house in itself was uninhabitable, and secondly, that through its contiguity to adjoining property, it never could be made habitable according to their standard; the statutory standard of free space for air and ventilation. The first case they tried was fought fiercely, and in that case, as in subsequent cases, the argument was used that this was the only estate available for the support of some spinster lady. They heard that argument in almost every case; it was always either a widow or a spinster; but they got their demolition-order all the same, and brought it home to the Court that there was no room for sympathy in the case, because the house had occupied a site which never should have been occupied, and the occupation of which deprived the tenants of the front property of the benefit of that back court for air, ventilation, washing-house, ashpit, and water-closet accommodation. The Court in these cases granted the order, and the property was taken down, the front property thereby getting the air and ventilation it was entitled to, and the rents of the front property went up. The advantage of taking procedure in a case of that kind against the owner of both properties was that thereby they avoided questions between different landlords, and of course, where the owner was the same in both instances, the element of compensation did not arise. They had followed out from 1890 until to-day the provisions of Sections 32 to 34, and under these provisions they had cleared out a number of these back lands in the City of Glasgow. It might be that it was peculiar, especially to Glasgow, that the owner was the same, but they had selected these cases for that reason, and in the last eight cases, dealing with property whose rental in some cases was over £100 a year, they had taken proceedings and, consequent on the decision of the first case which he had referred to, prior to the new orders in these eight cases, the owners of the latter had come and said that rather than fight these cases and run the risk of being found liable in the Court expenses, they would pull down the property. This was done at the last term of Whitsun and the Corporation had had no more difficulty. They had not started any case where compensation was exigible, and they had successfully avoided the application of Section 38, which merely referred to an "obstructive" building which in itself might be fit for human habitation. Their main contention all through had been that the house was unfit and could never be made fit for human habitation for the reason that it was surrounded at the sides by property belonging to other people, but mainly at the front by property belonging to the same owner. The Glasgow Corporation had in their Building Regulations Act a provision which assisted them to a great extent by stipulating that there could be no sleeping apartment used which had not available to it as free space one half of the height from the floor to the ceiling of the particular house: and they caught most of the landlords

of old and dilapidated property upon that point, because the front of the back building was so near to the back of the front building that the houses could not possibly get that space. In the last case fought against the Glasgow Corporation the objection had been taken that the medical officer in his representation did not state what was required to make the house fit for human habitation. On behalf of the medical officer he declined to state it, and his argument was this: that, while under ordinary circumstances under the Public Health Act and the Local Acts, when an owner was called upon to remedy a certain state of matters they were bound to give a description, when dealing with the Housing of the Working Classes Act they were not bound to do anything of the kind, for this reason: that in the schedule annexed to the Act there was a statutory form of notice which did not provide for details, and the schedule, being part of the Act of Parliament, must be followed out literally, and they maintained successfully before the Court that, having taken the statutory form contained in Schedule A of the Act, it would have been illegal on their part to have gone beyond it and given details; and the Court sustained that contention and granted the closing order, and the property is now down.

Dr. W. Butler (Willesden) said he sympathised with the objection which Dr. Hill had raised as to having to specify, in applying for a closing order, what should be done in order to make the property habitable. He happened just now to have to deal with some premises under section 32, and he was in the anomalous position of having to prescribe what was required to put the houses into habitable condition under circumstances where it was impossible to carry the prescription out. He was dealing with houses which happened to be in precisely the condition described by the last speaker, these having been built upon the back area of surrounding houses. They were not the property of one owner, and they were in the most awful condition which it was possible to imagine houses used for human habitation to be in. He had purposed specifying what was requisite to put these into habitable condition, knowing all the time that it was altogether impossible that these requirements could be carried out; to have to prescribe for air-space, for instance, where there was not air-space available. But he was advised by the clerk to the local authority that if he did prescribe all that was necessary he would lose his case. Therefore he had to content himself with a prescription which was not adequate to the case. He had to prescribe what was best for the houses to make them habitable, and yet he had to fall short of what he knew was necessary to make them habitable so that he could get the order. And it was conceivable that the owner would carry out his prescription, and in the end would have produced an insanitary set of houses in place of some which were rather worse at present, and then make an application for the rescinding of the closing order, and he would be left, as a result of the operation of this Act, with houses which, although considerable sums of money had been expended on them to make them sanitary, remained in the end utterly insanitary. For such reasons as these he had great pleasure in endorsing the recommenda-

tions of Dr. Hill that the prescription should be omitted from the Housing of the Working Classes Act.

DR. BOOBBYER (Nottingham) said that, in dealing with insanitary dwellings under Part 2 of the Act of 1890 in urban districts, the responsible officers of such districts adopted slightly varying procedure, on account of the somewhat different interpretations of the Act given by their several legal advisers. A fair idea of the range of variation which commonly occurred might, he thought, be gathered from different opinions expressed by the contributors to the current discussion. Their own procedure in Nottingham, when citing an owner before the Health Committee, was to furnish this person with an architect's specification of the work required to render the house or houses complained of fit for habitation. Such a specification very often of course amounted to a *reductio ad absurdum*. The owner was perhaps called upon to achieve the impossible. He had possibly to raise all the floors of a house, the basement of which was considerably below the pavement of the street in which it stood. Or again, he might be called upon to provide through ventilation, ventilation which would necessarily involve the destruction of back-to-back houses. The ownership question was not commonly the main difficulty in county boroughs and other urban districts, but the magistrates who had to consider the applications for closing orders were often a very serious difficulty, especially in cases where there was often no appeal from their decision. He would give an example. A short time back he had condemned, seriatim, a large number of houses (between forty and fifty) in one district. The entire health committee of the city, and many other people afterwards, also examined the houses, and unanimously concurred in the condemnation. When the application for closing orders came before the local bench, the magistrates first asked the rentals; they were told from 1s. to 2s. 6d. per week. They then inquired whether the inmates could afford to pay more; the defendant counsel replied in the negative. They then asked whether there were any other houses in the city of so low a rental, and were told there probably were not. They finally said they would be no parties to a scheme for turning hitherto-self-supporting people into the workhouse, or worse, and dismissed the applications *en bloc*. It was often useful to put examples of this kind before inexperienced people of philanthropic bent, to afford them an idea of some of the possible difficulties of local authorities in endeavouring to deal with insanitary property. There was one very serious difficulty, due to an intrinsic defect in the Act of 1890, which was encountered after a closing order had been obtained. It was this: An order for demolition of insanitary houses could not be made unless such houses could be shown to be a nuisance to the neighbourhood. As it was commonly impossible to show that an empty house carefully closed up was a nuisance, within the meaning of this term under the Public Health Act, the empty house was frequently left standing indefinitely. It was, indeed, actually part of the routine duty of officers of the Health Department

to see that the houses did not lapse into such a condition, in some respects at least, as to justify the order for their demolition.

Dr. H. Manley (West Bromwich) said that the speeches which had been made had amply demonstrated the need for amendment of the Act. In regard to the question of prescription, he had always maintained that they were not bound, as in the Derby case, to put forward a specification in all these cases, but his town clerk had always held that he must. He would welcome any amendment of the law which would sweep away any doubt as to such a prescription being necessary. In regard to the appeal to Quarter Sessions, he was rather inclined to think that local authorities would get very little help from them, because, unless they were appealing to Urban Quarter Sessions, they would simply be appealing from one set of magistrates to their own colleagues; and it was very doubtful always whether they could get a quarter sessions bench to upset the decision of three or four of their own colleagues. It was not like appealing to the Borough Quarter Sessions where there was a Recorder. In regard to the demolition question, most of them would remember the great difficulty which Dr. Newsholme had at Brighton. It was difficult to prove that the closed house was a nuisance, although the area round that house might be a very great nuisance. It was often the haunt of tramps, and the depository of fæcal matter for the neighbourhood. It seemed highly necessary that they should have greater facilities for dealing with these insanitary dwellings, as in Glasgow.

Dr. T. Eustace Hill (Durham), in replying on the discussion, said that with one exception the suggestions in his paper had not been adversely criticised to any serious extent. He was glad to see that even Mr. Adams had agreed to two of the most important suggestions, numbers 1 and 2. Except in one or two particulars his paper applied to all sanitary authorities who were endeavouring to put the Act into force. The only suggestions separately affecting County Councils were numbers 3 and 5. Mr. Adams had asked why rural authorities should be put under the thumb of the County Council when urban authorities were not. His answer to that was that he suggested that urban authorities also should be put under the thumb of the County Councils where it was conclusively shown that urban authorities neglected their duties under this Act. It was undoubtedly a fact that the application of this Act was grossly neglected in very many rural and small urban districts. Although Mr. Adams had held that no alteration of the law was necessary with regard to the serving of the notice he thought that that point had been well discussed and it was not necessary for him then to say anything more respecting it. The case quoted by Mr. Adams, as having been before one of the local bodies, on the previous day, was a proof of the necessity for some amendment with regard to Schedules 3 and 4, and that gentleman's argument did not affect what he was urging, namely, that Schedules 3 and 4 should be amended so that the former would be used with

respect to a house which could not be made habitable, and Form A of Schedule 4 would then only be used in cases where the property could be made habitable, and the requirements necessary to make the house habitable would have to be stated in the notice. If that were done the needs of all classes of houses would be met. He thought Mr. Adams had rather raised a bogey when he spoke of the increased cost to local authorities if notice had to be given to the County Council before the order for closing was rescinded. He could assure him that there was no ground for such a fear, and he held most strongly that the order for rescission should not be granted without notice being given to the County Council. On account of the difficulties which the Durham County Council had had, they had recently requested every clerk to the justices to inform the County Council directly of any application for rescission of closing orders, and in two or three cases the clerks to justices had given them that information. In two cases he had himself seen the property, and in one case, where he was satisfied that the houses had not been made habitable, the owner was advised not to make his application, and in the other case certain other alterations were made before the closing order was rescinded. Mr. Adams's objection was only a bogey, and in practice would not be substantiated. In regard to Mr. Lindsay's observations it appeared probable that in England local authorities could proceed under Schedule 3 of the Housing of the Working Classes Act and could serve notice on the agent of the owner, corresponding in England to the factor in Scotland; but if they did that they had to prove that the property was injurious to health. Sometimes this was difficult, and undoubtedly the sanitary authority in its notice under Schedule 3 had to prescribe what repairs should be carried out, otherwise the notice would be bad. A point not impressed sufficiently by the paper was that the County Council, if they took action by default under Section 45 of the Act, could only proceed under Schedule 4, and they had therefore to serve the notice on the owner who must be the owner as defined by the Act; and it was in that respect particularly that he thought that the Act should be amended. He quite agreed as to the great difficulty at present with regard to the serving of the notice requiring an owner to make the house habitable, even though the house could not be made fit for habitation. The ruling of the clerk to his County Council was that in the notice all they had to do was to require the owner to make the house habitable and that no specification was necessary, but even in that case there was the objection that before the notice had expired the owner would probably endeavour to improve its condition, although it was impossible to make it habitable, and would therefore be going to needless expense, because, after all, the house would be closed. There was need for amendment in that case also. He was rather sorry to hear of Dr. Boobbyer's experience with the magistrates, but there was no doubt that the difficulty with the justices was a very real one and very hard to get over. But whilst he admitted that there was a natural objection on the part of the magistrates at Quarter Sessions to reverse the decision of their colleagues, he thought that in practice, where it could be proved that the decision of the Petty

Sessional Court was against the weight of evidence, there would be no difficulty in getting the decision reversed; and he therefore hoped that his suggested amendment as to appeal to Quarter Sessions would be included in any recommendations which that Conference might make for the amendment of the Act. He moved that the amendments suggested in the paper be approved by that Conference of Municipal Representatives and referred to the Council of the Institute for consideration and report.

Dr. Manley seconded the resolution.

Councillor Jowett (Bradford) said that their present manner of proceeding appeared to him to be somewhat defective, in that these recommendations might go forth to the public as the only amendments required in the opinion of that Conference when there might be other amendments which were equally required, but were not at present known to the Conference. But he supposed there was no help for it but to go on as they were doing.

Mr. Adams said that if these suggestions of Dr. Hill's were to go forward as recommendations to the Council, he wished to move an amendment in relation to Clause 5. In view of the evident desire of the Conference that certain powers of control should be vested in the County Councils, he wished to limit the exercise of such powers to both urban and rural districts containing a less population than 50,000. His amendment was: "That no power should be conferred upon County Councils to deal with an urban district with a population of 50,000 or with a rural district of such a population."

Councillor J. Kavanagh (Bishop Auckland) seconded the amendment.

Alderman Imrie (South Shields) said that this amendment brought up fresh matter for discussion. He held that the County Council was a great nuisance to the urban districts. In the midst of the Durham County Council's area was an urban district containing 50,000 inhabitants. They were hedged in, and the County Council took care that the urban district did not extend. The County Council would probably, by their want of careful sanitation in the district immediately adjoining that urban district, make it impossible for the part of the urban district nearest it to become a healthy district. How many towns had recently been applying for the extension of their boundaries? Under this Housing of the Working Classes Act in a large congested district, such as South Shields, they were constantly closing houses under a magistrate's order, and sometimes they got a demolition-order, but it was usually voluntary on the part of the owner because they had no power to demolish a house unless it was in a dangerous condition, in which case it became the duty of the city engineer to destroy it. What were they to do with the population that they were constantly removing? The proper remedy, of course, was to acquire land outside, but if they acquired land outside of their own area they were losing ratable value, and it was like a shopkeeper advising his customers to go elsewhere. What a sensible rating authority would do under such circumstances was to ask for

power to extend their area and to take in some of the agricultural land outside. Then in such a case the County Council intimated that it would oppose any such application. Only a year or two ago the South Shields Council applied for an extension of their boundaries, enabling them to take in a lot of unoccupied agricultural land in the immediate vicinity. It was contemplated to run out trams to this district; and, of course, without the modern facilities of trams, it would be a great hardship to take the working class population outside the town in this way. The County Council opposed them and the Rural District Council opposed them, and instead of getting the land they needed they got an insanitary area, densely populated, which they did not want. He would like to add to the resolution something like this:—"As the difficulty is mostly confined to densely populated urban districts, County Councils should be recommended to give every facility for these urban districts to extend their boundaries, and thus provide room for spreading out their population."

Mr. T. A. Guy (Bradford) again urged that there was a good deal in the way of useful recommendations which should be dealt with in addition to the matters included in Dr. Hill's suggestions, and he suggested that they should content themselves with passing a general resolution to the effect that the different authorities represented at that Conference should send in to the Council of the Institute particulars of any amendments which they thought to be necessary for the proper working of the Act, and that the Council of the Institute should take all these suggestions into consideration and make representations to the Government in accordance therewith. If that were done he thought some practical result would have been arrived at as a consequence of that Conference.

Mr. B. Hepworth (Heckmondwike) said he thought there were Urban District Councils with only 10,000 population which had quite as much intelligence, so far as the members of the Councils were concerned, as those with 50,000 population had. It seemed to him that they were making a way for swallowing up all smaller District Councils in England, however well they managed their business. He was entirely opposed to the County Councils having the power which was suggested in clause 5. He thought that the County Councils had more to do already than they could do well. The County Council seemed to be simply a huge body for spending money, and the less the Urban District Councils had to do with the County Council the better it would be for the people. He was speaking as a district councillor and a guardian.

Mr. Adams's amendment was then put and defeated.

Mr. J. Corrigan (Ince) moved the omission of clause 5.

Mr. W. Dyson (Kettering) seconded the amendment. He said that urban districts were quite capable of dealing with their own business. It seemed to him rather ridiculous that the powers should be handed over to the County Council in regard to a place like Kettering with a population of 30,000, when

they had three boroughs in the county with a population of less than 5,000 each which would be at liberty to control their own affairs.

Alderman Imrie (South Shields) expressed a hope that the Conference would not pass that amendment, for it would not suit the Northumberland and Durham districts at all. They would not get any improvement in the sanitation of the county districts if they passed that amendment, because the people in most of the rural districts were under the thumb of the landowner or the mine-owner, and in either case it would be practically impossible for sanitation to be carried on and improved, and they would be no better off than they were before the times of medical officers of health and the larger duties assigned to County Councils.

The amendment was put, and defeated by 17 votes to 10.

Mr. Adams then moved an amendment, "that the Council be asked to take such steps as are necessary to release rural districts with a population of 50,000 from the control of the County Council." He pointed out that many municipal boroughs with less population than that were free from County Council control, and said there was no reason why rural districts with that large population should not be in the same position.

The amendment was seconded, and, upon being put, was defeated.

Mr. T. A. Guy then moved, "that the Council of The Sanitary Institute be requested to ascertain the recommendations of the large towns of the country with regard to desirable amendments of the Housing of the Working Classes Act."

Dr. T. Eustace Hill said he would accept that as an addendum to his resolution, but he wished to point out that if too much time was taken up in doing what was suggested the influence of the Congress would be lost. The Bill would come before Parliament and be passed during that Session, and it would probably be a long time before there would be any other amending Bill.

Mr. Adams asked why the inquiry should be limited to the large towns, and said the bulk of the population was not in the large towns. Would Mr. Guy mind specifying that the opinions should be asked of Boroughs, and Rural District, and Urban District Councils.

Mr. Guy said he should prefer to leave it to the discretion of the Council as to whom they should make the inquiries from.

The proposed addendum was then put to the meeting and carried, and the recommendations contained in Dr. Hill's paper were carried as a substantive resolution.

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 855.

ADMINISTRATIVE VERSUS REGISTRATION COUNTIES.

THE NEED OF UNIFICATION.

By HENRY HANDFORD, M.D., F.R.C.P., D.P.H.,

Medical Officer of Health, Nottinghamshire C.C.

(MEMBER.)

IN bringing this subject before you I am aware that I am treading in the footsteps of previous would-be reformers; but the subject is increasing rather than diminishing in importance, and a solution of some kind is imperatively demanded.

Under the present system of registration districts the rural (sanitary) districts and the smaller urban districts are placed at a serious disadvantage as compared with the large towns, and in bringing this question before the Municipal Section I am appealing for their powerful aid in support of their country neighbours. We hear much at the present day of the depopulation of rural districts, but we see little done to make the country a more desirable place of residence.

The registration of births and deaths was commenced in 1837, before sanitary districts or county councils were formed, and consequently before there were any administrative counties.

The registration areas and registration counties are based on unions. The union authorities, namely the Poor Law Guardians, have little or no concern with the number and causes of deaths, but this is a matter of great importance to the sanitary authorities and to county councils. The quarterly returns of marriages, births, and deaths published by the Registrar-General would give information to the county councils and their officers from three to twelve months earlier than they at present obtain it, if the areas dealt with in the Registrar-General's returns coincided with the sanitary districts and the administrative counties; but they do not, and the returns are therefore, for county purposes, of little value.

By the Local Government Act of 1888, section 24, sub-section (2) (*d*),

the county councils "pay to the guardians paying the registrars of births and deaths for any district wholly or partly in the county" a certain sum annually out of the Exchequer Contribution Account. This should give the county councils some moral claim that the work of the registrars should be made available for county purposes.

The figures that I bring before you are for the County of Notts, which is fairly typical of many other counties. But in order not to weary you I will only select a few districts and relegate the full details to the Appendix.

At the census of 1901 the administrative county had a population of 274,716, whereas the population of the Registration County was 596,705, and included the City of Nottingham. The population of the registration county excluding the City of Nottingham numbered 356,962. The population in the Registration County of Notts residing in other administrative counties was 99,142, and the population of the administrative county residing in other registration counties was 16,896.

To come next to the registration districts; the whole of the Basford Registration District has a population of 146,747, many of whom are in Derbyshire, whereas the Basford Rural (Sanitary) District has a population of 38,365. Again, Warsop, a registration sub-district of the Mansfield Registration District, has a population of 7,064, whereas the Warsop Urban (Sanitary) District has a population of only 2,132. Consequently, the list of births and deaths in the quarterly returns of the Registrar-General conveys no useful information to the Warsop Urban District Council or to the County Council.

I need not multiply examples, but will content myself with saying that the change that is necessary is the following.

The births, marriages and deaths in Nottinghamshire should be published for the twenty-six urban and rural districts (which are sanitary divisions) instead of for twenty-nine registration sub-districts; the total would then be that of the administrative county instead of the registration county. To bring this change into effect one of two things is necessary: the boundaries of the unions must be altered so that they may coincide with sanitary divisions and not overlap the county boundaries, or the urban and rural districts must be formed into registration districts. The wholesale alteration of the boundaries of unions, with all the difficulties arising from inequality of rating and other causes, would be an enormous undertaking with very little prospect of success.

It would appear from the reply of the President of the Local Government Board in Parliament on April 30th, 1903, that under the present

law the vital statistics of the Registrar-General cannot be published for the urban and rural districts instead of for the existing registration districts. I would, therefore, urge the necessity of a short Act of Parliament making the registrars of births and deaths, officers of the sanitary authorities, who are most deeply concerned with vital statistics. The urban and rural districts would then become registration districts or sub-districts, and the registration county would be the administrative county.

I will end this short paper by asking the Section to receive and support the following resolution.

At the meeting of the Executive Council of the County Councils Association on April 22nd, 1903, the Council considered a reply received from the Local Government Board to the Resolution passed by the Council on January 28th, with reference to the areas of registration and administrative counties.

On the motion of Lord Belper, seconded by Mr. Dymond, it was resolved:—

> "That it is desirable that the Registrar-General's quarterly and annual returns of births, deaths, and marriages should be published according to sanitary districts (*i.e.*, urban and rural council districts), instead of as at present according to poor-law districts; and that, if necessary, the registrars should be made officers of the sanitary authorities, who are the authorities most deeply interested in vital statistics."

From the reply of Mr. Long, which I append, there seems a fair prospect of a satisfactory alteration of the existing practice, if The Sanitary Institute and other influential bodies interested in the public health will unite in urging the matter.

In the House of Commons (Thursday, April 30th), in reply to Mr. Henry Hobhouse, whose question referred to the desirability of publishing the Registrar-General's quarterly and annual returns of births, deaths, and marriages according to sanitary districts (*i.e.*, urban and rural district councils) instead of as at present according to poor-law districts, Mr. Long said:—

"I have been in communication with the Registrar-General on this subject, and I find that he considers himself bound to publish statistics for registration districts and sub-districts, which, as contemplated by the Births and Deaths Registration Acts, correspond with poor-law unions and divisions of such unions. It would be impracticable, therefore, to issue the statistics for the sanitary districts instead of for the existing areas. The Registrar-General also informs me that if it was proposed to treat these districts as statistical units in addition to the present areas, this arrangement would involve an enormous amount of extra labour and a

large increase in the staff of his office. At the same time, I sympathise with the object which my right hon. friend has in view, and perhaps some modified proposals might be made on the subject. If this is done, I will take care that any such proposals shall receive thorough investigation."

APPENDIX.

NOTTINGHAMSHIRE.

Registration Districts and Sub-Districts.	Population, Census 1901.	*Urban and Rural Districts.*	Population, Census 1901.
EAST RETFORD.			
Gringley	3,019	Eastwood	4,815
Clarborough ..	6,353	Hucknall Huthwaite	4,076
**East Retford* ..	*11,812*	*East Retford* ..	*12,340*
Tuxford	4,435	Kirkby-in-Ashfield ..	10,318
		Mansfield Woodhouse	4,877
WORKSOP.			
Worksop	*16,209*	*Worksop*	*16,112*
Carlton	3,161	West Bridgford ..	7,018
Anston .. .	6,318	Blyth and Cuckney	4,562
Carburton ..	13,552	East Retford (Rural)	14,239
		Leake	3,709
		Misterton	3,618
MANSFIELD.			
Warsop	*7,064*	*Warsop*	*2,132*
Pleasley	13,481	Newark (Rural) ..	7,738
Blackwell	15,740	Skegby	5,478
Sutton-in-Ashfield	*22,818*	*Sutton-in-Ashfield* ..	*14,862*
Mansfield	*21,445*	*Mansfield*	*21,445*
Blidworth ..	1,070	Stapleford	7,873
		Kingston and Ratcliffe	413
BASFORD	..	*Basford*	*38,365*
Greasley	40,521		
Ilkeston	39,833		
Beeston	*9,501*	*Beeston*	*8,960*
Hucknall Torkard	*18,428*	*Hucknall Torkard* ..	*15,250*
Arnold	*13,173*	*Arnold*	*8,757*
Carlton	*19,983*	*Carlton*	*10,041*
Wilford	5,308		
NOTTINGHAM.			
Nottingham S.W.	39,502		
,, S.E.	33,693		
,, N.E.	66,282		
,, N.W.	58,380		
Bulwell	41,886		

* In the above Table, where the names of the Registration Sub-Districts and the Urban or Rural Districts correspond they are printed opposite one another and in italics, in order that the differences in population may be compared. In the other cases the districts are so mixed up that no comparison is possible.

SOUTHWELL.			
Southwell	*10,819*	*Southwell*	*19,114*
Kneesall	8,295		
NEWARK.			
North Collingham ..	4,322		
Bassingham	2,132		
Newark	*16,085*	*Newark*	*14,992*
Balderton	3,925		
Claypole	4,407		
BINGHAM.			
Bingham	*13,753*	*Bingham*	*13,612*
Total, Registration County	**596,705**	Total, Administrative County	**274,716**

PARTS OF THE REGISTRATION COUNTY OF NOTTINGHAM IN OTHER ADMINISTRATIVE COUNTIES.

In the Administrative County of Derby.

Ault-Hucknall	1,582	Ilkeston	25,384
Barlborough	2,056	Pinxton	2,994
Blackwell	4,144	Pleasley	8,448
Clowne	3,896	Scarcliffe	2,525
Codnor and Loscoe	3,831	Shipley	657
Codnor Park	933	South Normanton	5,170
Elmton	2,575	Tibshelf	3,432
Glapwell	111	Upper Langwill	342
Heanor	12,418	Whitwell	3,380

In the Administrative County of Leicester.

Barkston	270	Plungar	194

In the Administrative County of the Parts of Kesteven (Lincoln).

Allington	239	Hougham	200
Barkston	413	Long Bennington	737
Bassingham	614	Marston	241
Beckingham	272	North Scarle	433
Bennington Grange	9	Norton Disney	171
Brant Broughton	558	Sedgebrook	194
Carlton-le-Moorland	254	Stapleford	154
Caythorpe	903	Stragglethorpe	69
Claypole	542	Stubton	110
Dry Doddington	149	Swinderby	423
Fenton	62	Syston	187
Foston	297	Thurlby	109
Fulbeck	645	Westborough	153

In the Administrative County of the West Riding of York.

Dinnington	258	Thorpe Salvin	399
Firbeck	231	Throapham	90
Gildingwells	66	Todwick	311
Harthill with Woodall ..	1,154	Wales	2,398
Letwell	110	Woodsetts	248
North and South Anston ..	1,394		

Total in other Administrative Counties .. **99,142.**

Ald. Newton (Newcastle-upon-Tyne) said he thought it would be admitted by all who had had experience that certification of death should be substituted for registration, because a large number of deaths were registered in this country which were not certified, and, such being the case, for the purpose of collecting accurate statistics the registration figures were useless. Unless they had a sound and uniform basis upon which to found their figures the registration of deaths was simply useless for professional or statistical purposes, for the figures based upon registration only were erroneous and misleading, and unless they could have correct data upon which to base their superstructure the statistics would not bear the weight and value that they ought to do.

Mr. T. A. Guy (Bradford) said that he thought the alteration proposed by Dr. Handford was very desirable in consequence of the fact that these statistics had to be prepared in the urban and rural council districts. It was these councils which had to do with sanitation and other matters affecting the health of the people, and not the boards of guardians, and it was evident that these figures would not be useful if they were given simply for poor law union districts.

Dr. Boobbyer (Nottingham) said he would like to point out that however desirable the alterations suggested by Alderman Newton might be, they were not in any way cognate to those which formed the subject of the paper. Dr. Handford's suggestion was the unification of areas for all purposes. Looking at the matter from a statistical standpoint they saw the immense advantage of unification in the case of many of the large cities, when the city boundaries were made identical with those of the parish, and all the figures published for the nominal unit of area referred to the whole circuit of the city without any overlapping. The anomalous condition of things referred to by Dr. Handford absolutely destroyed the value of the vital statistics to public bodies.

Mr. Guy seconded the resolution moved for Dr. Boobbyer, and it was carried.

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PRACTICAL TRAINING BY THE SANITARY INSTITUTE FOR MEAT INSPECTORS.

By A. WYNTER BLYTH, M.R.C.S., F.I.C., F.C.S.
Barrister-at-Law.
(Fellow.)

THE system of training and examination for the purpose of qualifying men to act as Meat Inspectors, adopted by The Sanitary Institute, originated from the conclusions of the Royal Commission of 1901, and was stimulated by a circular letter to Sanitary Authorities issued by the Local Government Board, urging the importance of appointing properly qualified Meat Inspectors.

The Institute in dealing with the subject, considered that the education of a Meat Inspector should not be on too narrow a basis, and therefore very properly extended both the instruction and the examination so as to embrace all varieties of food.

Hence the more appropriate title of those who have succeeded in qualifying themselves would be "Inspectors of Food" rather than "Meat Inspectors."

So far as I know, outside the schools of human and veterinary pathology, the Institute is the only place where a person who is neither the holder of a medical or veterinary diploma can obtain adequate training in the inspection of meat and other food.

I suggest that a large number of Sanitary Authorities would find it useful, and to the public interest, to give facilities for their officers to take advantage of this important instruction.

The course of instruction occupies two months; it consists of a succession of demonstrations at a large Metropolitan cattle market where the students see the live animals destined for slaughter, and watch the whole process of stalling, slaughtering, cutting up, and preparing for sale as well as the arrangements of markets and byres. Demonstrations are also held weekly at the Parkes Museum.

At these demonstrations healthy and diseased organs are shown; whole carcases of various animals are even obtained for the purpose of illustrating

various points, such as the instruction of students in nomenclature, in the situation of glands likely to give the first evidence of disease and in pathology generally. As an example of the thoroughness of the demonstration the following is a list of the specimens shown to the students, April 6th, 1903—

List of Specimens at Meat Demonstration in Parkes Museum on Monday, April 6th, 1903.

Two sides of oxen, showing tuberculosis.
Carcase of pig, showing tubercle in sub lumbar glands.
Carcase of sheep that had died a natural death, not slaughtered.
Side of Jersey cow, yellow and dropsical.
Side of pig, showing pleurisy and peritonitis.
Fore-quarter of ox with tuberculosis ; stripped pleura.
Head of ox enlarged from effects of actinomycosis.
Skull of ox showing disintegration of bone by actinomycosis.
Bones of horse and ox.
Liver of tuberculous ox.
Pig's pluck, showing tuberculous lesions in lung, liver, and glands.
Liver of sheep and pig, showing echinococcus veterinorum.
Udder of cow showing tuberculous lesions.
Udder of cow showing mammitis or mastitis.
Fore-quarter of pig, showing swine fever.
Slink veal.
Cysticercus tenui colis in omentum of sheep.
Liver of pig, showing hydatid cysts.
Several tongues, showing actinomycosis in different stages.
Cysticercus Cellulosæ.
Several livers, showing cirrhosis and flukes.
Pyæmic abscess in liver of sheep and pig.
Parasitic pneumonia in liver of sheep.
Spleen and kidneys of ox and pig, showing tuberculosis.

The photograph of specimens used at one of the demonstrations in the Museum will, perhaps, convey even more forcibly the educational value of this course than any written description.

In addition to the inspection of cattle markets and the demonstrations there is a course of lectures, the syllabus of which includes instruction in the laws applicable to food inspection, the characters of sound and unsound food generally, the hygiene of byres, cowsheds, slaughterhouses, and other places destined for the housing of living animals, and the storage of various substances destined for consumption as food.

It is useful to show in a condensed form the class of persons who

Morbid Specimens arranged in Parkes Museum for demonstration to Students.

have availed themselves of instruction since 1899; this is clearly illustrated by the following table:

Table *showing Occupations and Numbers of Students attending The Sanitary Institute's Courses of Practical Training for Meat Inspectors, from* 1899 *to the present time:—*

Year.	Veterinary Surgeons.	Food Inspectors.	Sanitary Inspectors.	Butchers.	Salesmen.	Various.	Total number of Candidates.	Total number certificated.
1899.....	2	4	5	—	—	2	13	9
1900.....	4	7	19	—	2	—	32	17
1901.....	6	3	20	7	—	5	41	22
1902.....	5	6	44	5	—	6	66	47
1903 (to June) ...	1	—	10	3	—	2	16	12
Total	18	20	98	15	2	15	168	107

It will be observed that the largest class in point of numbers, by far, is the sanitary inspector, although probably the largest proportional number—that is to say in proportion to the numbers existing—is the class of food inspector. A considerable number of towns have found it necessary for the proper supervision of their markets to appoint as food-inspectors men who devote their whole time to the work, and these men naturally find the instruction valuable, and the certificate enables them to command the higher paid posts. Seeing that since 1899, 107 persons up to the present time possess The Sanitary Institute Certificate certifying that they are fully qualified to act as food inspectors, and that each year the numbers of students in this branch are increasing, Sanitary Authorities have ample facilities for the appointment of inspectors who have received a sufficient practical training to carry out efficiently the statutory requirements of the Public Health Acts, and any by-laws or special regulations relating to food.

Not only the general public, but also the various trades concerned, the traders in milk, in meat, in canned goods and others, demand, of all things, efficiency in the inspection of food; they demand, so far as regulation can effect such an object, that disease and mortality produced from contaminated, unwholesome, or diseased foods may be prevented, but on the other hand that nothing which is appropriate for the nourishment of man shall be ignorantly condemned or wantonly destroyed. This demand can only be satisfied by appointing qualified men trained practically on the lines sketched out.

OPEN SPACES.

By THE METROPOLITAN PUBLIC GARDENS ASSOCIATION.

A PAPER on the subject of open spaces, and what may be done to beautify our towns, was read before the Congress of The Sanitary Institute at Manchester. It is not necessary, therefore, to go over the same ground, but rather to point out some recent developments in connection with this work. Voluntary agencies, similar to the Metropolitan Public Gardens Association, are much needed in various parts of the country. The cities increase rapidly, notwithstanding all the efforts put forward to keep the people in the rural districts, or "to bring them back," as it is popularly expressed, "to the land." Such earnest investigators as Mr. Rider Haggard, who recently gave an interesting discourse upon the subject at the Royal Institution, and such useful societies as the Country Holidays Fund and the Garden City Association, are all labouring with a certain amount of success and of hope, but still the general tendency is townwards, and still the builders find occupants for the ever-spreading rows of new streets around our cities. It sometimes seems impossible for those who are promoting open spaces, whether public authorities or voluntary workers, to cope with this tendency. A field is bought in a day and covered with houses in a few months, while in order to secure an open space of similar size years of patient negotiations will often be needed, besides the collection of a large sum of money drawn with difficulty from the local or surrounding public authorities. But in this connection, as in so many other ways, what is most worth doing may be hardest to do, and the present generation cannot over-estimate the benefit accruing from the parks and public gardens which have been acquired, while to future generations these open spaces will probably be even more useful. The Metropolitan Public Gardens Association is prepared to assist in the formation of similar societies in provincial towns, for, although the laws relating to open spaces are now very complete, the local authorities, who have the power to provide recreation-grounds, often need to have opportu-

nities brought to their notice, and preliminary negotiations carried through, by a body of private persons who are interested in the matter.

The Association has lately drawn up a comparative table of public spaces and population in some of the principal cities and towns of the United Kingdom, showing the relative changes which have taken place during the past twenty years. This is published in the last annual report, and can be obtained from the Secretary at 83, Lancaster Gate, London, W. At the close of 1902 Bradford, with a population of 280,000, was in possession of eighteen open spaces, containing an area of 316 acres, and acquired at a cost of £46,300. This shows an average number of 302 persons to one acre of open space, which is a fairly good one compared to that of several other towns in the middle and north of England. The table contains details respecting 46 boroughs in the United Kingdom, and the number of persons per acre of open space varies from 97 at Lincoln to 2,913 at Coventry. This last place, it may be interesting to note, has spent very little public money in the acquisition of open spaces, 18 out of the 24 acres of recreation-ground within its area having been gifts to the people. The details connected with Harrogate, being a town in the neighbourhood of Bradford, may also be of interest to the Congress. It has a very creditable record, there being in 1902 an estimated average of 107 persons to the acre of open space, the open spaces themselves measuring 266 acres, acquired at a cost of £64,880.

There are certain fundamental truths which it is well to bear in mind. First:—The value of property is enhanced if there is a sufficiency of public or private garden-land amongst the streets, and the houses fringing an open space can be more highly rated than those in closely packed rows. Second:—In any case where public land is curtailed for railway purposes or other public improvements, an equal area in the same district should be acquired for an open space, or sufficient compensation should be provided for the purchase of such an open space. Third:—No public recreation-ground should be laid out without due provision being made for its future maintenance. This is generally done by the owners transferring it under the Open Spaces Act to the local authority, and in the case of a church-yard the incumbent for the time being of the church to which it is attached is the owner. And here it may be well to draw attention to a recent decision in the House of Commons. The law of the land is, that no building can be erected on ground that has been set aside for interments, excepting for the enlargement of an existing place of worship. This renders disused burial-grounds all over the kingdom valueless as building-sites and more easily obtainable as open spaces. In some recent cases the

owners of such grounds have managed to build schoolrooms and halls in them, on the plea that these were enlargements of churches, but the London County Council, mainly owing to the efforts of the Metropolitan Public Gardens Association, now receives notice of all applications for faculties to build in burial-grounds, so that opposition may be organised in time in those cases where the law appears likely to be infringed. A more flagrant case lately came to light, a private bill being promoted to remove this disability from a disused burial-ground in the City of London, so that its owner might use it as an ordinary building-site. The Bill passed the House of Lords, but was thrown out on second reading in the House of Commons, by 118 votes against 71, when the following useful declaratory amendment, proposed by Mr. Paulton, Member for Durham, and seconded by Sir Joseph Dimsdale, Member for the City of London, was carried:—"That this House declines to sanction a Private Bill in contravention of general public Statutes concerning open spaces, for the express purpose of enhancing the value of a private estate."

If there is a house or mansion in a park acquired as an open space it should be put to some public purpose in connection with the park, such as a public library, museum, shelter, refreshment rooms, superintendent's quarters, &c., and not (unless so stipulated at the time the ground is purchased) be afterwards allocated for the use of some special class of people, a portion of the open space being cut off to form a separate garden for the house. It will be remembered that this difficulty recently arose in connection with Golders Hill, the whole of which estate was secured for the public by private and public subscription. The London County Council suggested using the house as a permanent convalescent home, when a considerable strip of the most attractive part of the ground would have been taken to secure a proper privacy for the institution. So strong an opposition was organised by those who had bought the park that the Council had to abandon this scheme, but there are other cases, somewhat similar to Golders Hill, in which the houses are to be let for outside purposes. Another danger of modern times is that the free use of common lands is occasionally interfered with by portions being let for special games. If golf clubs and such-like institutions would rent fields and so keep them from being built upon they would be doing public service, but when an existing open space is curtailed for the benefit of a limited number, serious damage is done to the public cause. It seems well that these difficulties, which have occurred in and around London, may be mentioned, as they are of a kind which, if not guarded against, may occur in any other town.

The Earl of Meath, Chairman of the Metropolitan Public Gardens Association, gave evidence last year on the subject of the need of increased facilities for the physical culture of the youth of the lower classes, before the Royal Commission (Scotland) appointed to report upon the subject. It has been only too clearly demonstrated that the general physique of our town-bred populations is steadily deteriorating. In this respect a lad born and brought up in a city will generally compare very unfavourably with one who has remained in the country. He will be undersized, delicate, and predisposed to consumption, nervous diseases, and insanity. For this reason it is imperative that more systematic physical training should be given in all elementary schools; that the playgrounds, *i.e.*, the out-door school premises, should be used as much as possible both during and after school hours; that every encouragement should be given to organised games on Saturdays and other holidays; and that the number of public playgrounds, public gymnasia, and playing fields in the suburbs should be largely increased. The additional means of cheap transit now provided by Tramway Companies and County Councils should do much to render this possible, and although residents in hitherto quiet suburbs may have much cause of complaint and may be deserving of genuine sympathy, yet, on the other hand, the benefit to the dwellers in the central districts of the towns is undoubtedly very great. And it must be remembered, as a compensation, that the greater the number of roads used for tramways and light railways the less each of these roads is likely to be used. It is the same with public recreation grounds in crowded districts: each one that is added serves to make the others quieter and pleasanter for those who use them.

The questions of physical training and the provision of open spaces are closely allied to one another, the former being, to a certain extent, dependent on the latter; and if only for the sake of giving a chance of improvement to the next generation, it would be well for all British cities to be up and doing in this matter, and for the local authorities to lose no opportunity of securing, before it is too late, all the available open spaces in and around their towns.

So large a subject as open spaces cannot be treated in any exhaustive manner in the course of a short paper, but the matter is an important one to the health and happiness of the community. It will be useful if some practical discussion may arise out of the hints and suggestions which we have endeavoured to thread together under this very extensive heading.

CONGRESS AT BRADFORD.

CONFERENCE ON INDUSTRIAL HYGIENE.

PROVISION FOR THE HEALTH OF WOMEN AND CHILDREN IN LAUNDRIES.

By EDITH L. MAYNARD,

Secretary Industrial Law Committee; Late Sanitary Inspector at Sheffield.

(Associate.)

ABSTRACT.

A LARGE number of Laundries are wholly outside the scope of any regulations, namely, Institution Laundries, Domestic Laundries, and Laundries where not more than two persons dwelling elsewhere are employed.

For the Laundries that come under the Factory Act the regulations are wholly inadequate, both on account of the long hours which are legally permissible, and also on account of the loopholes in the law which render its evasion an easy matter, and make thorough inspection impossible.

The trade is an unhealthy one (1) on account of the long and irregular hours worked; (2) on account of the dangerous, and in many cases, unfenced machinery employed; and (3) on account of the unwholesome atmosphere in which the work is carried on. Further legislation is called for.

Miss Vynne (Secretary of the Free Labour Defence Committee) said that there were one or two things in Miss Maynard's paper on which she should like to comment. One was the great difference in regard to institution laundries between sanitary inspection and inspection under the Factory Acts. She would

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Note.—The proceedings of the Conference commenced with an address by Prof. T. Oliver, M.A., M.D., LL.D., F.R.C.P., F.R.S.E. (*see page* 171).

like to mention that a good many institution laundries had voluntarily placed themselves under sanitary inspection, and she believed that many others would be willing to do so. But between that and the application of the factory-system there was a wide difference. The application of fixed rules as to hours would make it next to impossible to carry on the work of the institutions. It must be remembered that the inmates of most of such institutions were there for their own reform, by their own consent to a great extent: she was speaking of the religious institutions. The great difficulty would be to accept factory-hours. As one matron of such institutions had told her, the women were mostly as excitable as children. If, for instance, a woman in a fit of temper threw down a basket of clothes and stamped upon them, as sometimes happened, there was nothing that the matron could do by way of punishment but say: "You must wash all those clothes over again before you stop work." If the woman could point to fixed hours for ceasing work, and the authority of the inspector, there would be an end of discipline. The only way that discipline could be maintained was by the promise that if the women worked well they should have a holiday on a certain occasion, but that if they did badly they should not. If definite holidays were fixed by law this would be impossible. It must not be forgotten that the women were in the institutions of their own free will. If they had reason to be dissatisfied with the treatment which they received they could go. Miss Maynard had spoken of institutions making several thousands of pounds a year profit. Surely if any such existed they would come already under the Factory Act, because it was a misnomer to call an institution a charity when a profit was made. If they did, they were not *bona fide* "charities," and they could be prosecuted for breach of the Factory Acts. In regard to the hours worked in large steam laundries, which were really factories, she had nothing to say, because every woman knew (though possibly every man did not know) the great advantage which the large laundries had in being able to finish clothes off in a single day. It was, therefore, perfectly easy for such factories to keep regular hours. At the time that this matter was before the House of Commons she inspected the laundries round the docks. A great many women made their living by washing there. But their work had always to be done in a hurry. A sailor would bring his washing, and had to get it back completed in time to sail by the next tide. Two or three very long days were the entire week's work. It would be doing a very serious injury to these women to prevent them working on the two or three busy days of the week more hours than the women who were employed in factories for a full week. On the whole, she thought that the weekly time limit rather than the daily time limit was the fairest in its operation on the smaller class of laundries. A reference had been made by Miss Maynard to the case of France, but France was totally different from England in its arrangements. The excellent system of wash-houses made the long hours of little home laundries unnecessary, by placing the very best appliances and machinery at the disposal of private washers.

Miss Maynard (London), in replying upon the discussion, said that she would attempt to reply first to Miss Vynne's points. That lady had not referred to the long hours worked under unhealthy conditions which were always to be found in laundries free from inspection. The only plea she had raised was that of the loss of work on the part of some workers. That plea of loss of work was the usual bugbear when any improvement of social conditions was proposed. In time a level would be found again. There was individual suffering following on the enforcement of every good law at first. It was not a question whether certain women at this present time would lose work, but whether the conditions of future generations of workers in laundries would be better under stricter regulations than they were now. Miss Vynne seemed to have an idea that Institutions were at present only willing to be under sanitary inspection, but many had replied to the Home Office inquiry on the subject that they were willing to come under Government inspection; and she would repeat that in France, a specially Roman Catholic country, convents, refuges, and similar institution laundries were all under Government inspection, and the sisters and nuns there found they could carry on the work under the ordinary factory laws. Those facts showed the practicability of the thing. It was suggested that the matrons feared that the visit of the inspectors might militate against their authority. But so long as the law was being kept the inspector would have nothing to do but to congratulate the matron on the way in which the laundry was being conducted. Miss Vynne seemed to fancy that large profits were not being made in such laundries; but the names of the institutions and the facts could be seen in the Charity Register. The law might easily be adapted to meet the case of the laundries, and it should be so adapted. Miss Vynne had taken her stand upon the absolute necessity that articles to be washed should be collected on one special day and sent home on one special day. She herself did not see why. It was certainly done, but no one can say why, and it was a delightfully conservative idea that because it *was* being done the custom must be continued. But if regulations were brought in, laundry proprietors would soon adapt their work to the altered conditions. It would not be the laundries which would suffer, but the customers, if anyone suffered at all, which she did not believe. As the President had said, more than a certain amount of work could not be done well, and long hours simply meant that the work was badly done. In France (and she insisted strongly upon the example of that country) laundry-work was not considered an exceptional trade, and she had always found that it was possible to get one's washing done there quickly and well. She did not see why, for the sake of bolstering up the little home-laundries, thousands of women should be obliged to work these excessively long hours.

FACTORY LEGISLATION FROM AN EMPLOYER'S POINT OF VIEW.

By W. H. MITCHELL.

ABSTRACT.

THERE is probably no industry in Great Britain in which the conditions of work have ever been so bad as they were in the worsted trade of the West Riding before the passing of the Factory Acts. I do not know of any industry in which the conditions of employment are now so carefully safeguarded by the state.

Here is a condition of things that gives opportunity for consideration of the effect of state interference between employers and employed, where we can measure the actual results. During a period which covered a large part of the first half of the nineteenth century, there was practically no limit to the hours which might be worked in a worsted mill, nor to the age at which a child might begin to work. No protection from danger. No consideration for health. The condition of the workers under these circumstances was as bad as possible. The Ten Hours Bill, which established the right of the state to control the industries of its people, so far, at any rate, as to enable it to protect its women and children, put an end to this state of things. Further legislation on the same lines has steadily reduced the hours of labour, insisted upon greater precautions for the safety of the workpeople, enforced better sanitary conditions, protected the workers in many ways, and gradually raised the age at which a child is allowed to commence work.

What are the results from an employer's point of view? An employer naturally desires to secure the greatest amount of efficient production at the smallest cost. Before this legislation he sought to obtain this by means of long hours, low wages, and reckless disregard of the welfare of those who worked for him. He has found out that long hours and low wages mean bad work. That to get the best out of machines which have to be worked by human beings, the health and strength of the worker is

as important as the condition of the machinery. That the best machinery, the best workers, the best work, and the best production can alone give him the results he desires. The Factory Acts have helped employers to success by compelling them, as a whole, to do what the most enlightened of them were always anxious to do, to turn their attention from the old wasteful and ruinous methods of trying to obtain large production by long hours of work and economy by low wages, to the only way of obtaining these results satisfactorily, by means of improved machinery, better management, and more efficient workers. By establishing a standard of health, comfort, and safety to which all must conform, by helping by means of carefully-trained inspectors not only to enforce that standard, but to point out to employers how it can be attained, they have done much to make our worsted-mills as free from risk of accident, and as healthy to work in, as is possible under the circumstances.

By a strict limitation of the hours of labour they have put all employers upon an equal footing, and removed the temptation to gain temporary advantage by longer hours of work. By this limitation, and by preventing very young children from commencing work at an age when their strength will not bear the strain, they have given us a stronger and healthier, a more intelligent and efficient race of workers. Indeed, we may say of our Factory Legislation that it has replaced a generation of overworked, inefficient operatives, with no interest in their work, no desire for improvement, by a generation who are, on the whole, active, intelligent, interested in their employment, and capable of aiding in any development that may be necessary. It has thus, whilst conferring an inestimable boon upon textile workers, prepared the way for the adoption of those modern methods which can alone enable us successfully to face the keen competition of other nations. The best machinery, the most efficient workpeople, the largest possible production, and the best possible work, can alone command success. We should have had neither the machinery, the workpeople, the production, nor the quality of the work that we now have, had it not been for the Factory Acts. Never was our production so large, never was the work we turn out so good, as it is to-day. There are those who say that the best thing the State can do for the industries of a nation is to let them alone. The Factory Legislation of Great Britain is a standing proof of the fallacy of this position.

Surgeon-Major Hutton (Leamington) said he took it that Mr. Mitchell's subject did not confine the discussion to any narrow point of view, and he

supposed the Conference might consider any aspect of the relations of master and employed. Although he had not seen a great deal of factory work, yet he had seen some, and he had for many years past (for over half a century) had experience of the various industries of many industrial and mining centres. When they reflected on what had taken place during the last fifty years, they must see that a marked improvement had been accomplished in preventing accidents in coal mines, and also in alleviating pain and suffering when accidents had taken place. Some time ago an excellent address was delivered by the President of the North of England Institute of Mining and Mechanical Engineers, Sir Lindsey Wood, on this subject. He (Surgeon-Major Hutton) attributed this improvement to (1) wise legislation; (2) to extended education leading to greater intelligence; (3) to a greater appreciation of the value of human life; and, he must add, (4) to the work in which he had been engaged in organising for over twenty years, the St. John Ambulance Association. He had had considerable experience in the Newcastle district, both in early life, and also in recent years. For several years he had visited the works of Armstrong, Whitworth & Co., at Elswick near Newcastle, and they had now in those great works, employing some 20,000 men, an excellent system of ambulance work. He had the fact from his old friend, Sir Andrew Noble, that the St. John ambulance instruction had been the means of saving much pain and suffering in cases of accident. He could gladly corroborate what had been said by Mr. Mitchell in regard to legislation; they must not, however, expect too much from it. He feared sometimes that some people, especially in Congresses of this kind, bothered the Government to legislate too much. He contended that they ought to carry out their efforts, as much as possible, on voluntary lines; he had a great regard for voluntary effort, for he believed that good work was got out of such effort. He had always objected to any Government grant in connection with the St. John Ambulance Association, as he did not believe in such grant for its work. He believed in the hearts of the people being stirred up to support a work of that kind, and that voluntary effort was of the greatest possible assistance to a government in carrying out anything for the saving of life. He was not one of those who took a gloomy view of things to-day. He believed the country was improving, and that with extended education and the various philanthropic institutions, great good would come to the nation in the future.

The President (Prof. T. Oliver, M.D., F.R.S.E.) said he did not think that anything was more likely to promote the cause of factory legislation in this country than such a paper as that to which the Conference had just listened. It was a pleasure to listen to it. In the last speaker they had a gentleman who had had practical experience, extending over a large number of years, of the working of the Factory Acts. Mr. Mitchell was one of those employers who acknowledged that the Factory Acts had not diminished but rather improved

trade. Certainly things were very bad in the Bradford district before the passing of the Factory Acts, but thanks to them the conditions of factory life had very much improved all over the country, and especially in and around Bradford. Mr. Mitchell had made the very interesting remark that, as an employer of labour, he was interested in seeing how much could be got out of machinery, but that, as he had not expert knowledge of such a thing, for example, as sanitation, he therefore availed himself of any suggestions which might be made by the sanitary inspector, just as he would also welcome any suggestions made to him by the workpeople. That was the kind of employer the country wanted. There are employers who, so far as the health of their workpeople and risks to life are concerned, are always in advance of the requirements of legislation. And there are just the reverse of these. Take, for example, the safe-guarding of machinery; it is a remarkable fact that, although proper guards are necessary for machinery, yet certain manufacturers have stated that they could not find a market for machines that they had sent out guarded; in other words, machinery that is properly guarded is not so saleable an article as that which has no guards at all. It was a pity that this should be the case. He expressed the hope that an improvement in this respect would soon be seen. Surgeon-Major Hutton made, it seemed to him, a telling point in regard to accidents in mines, for he attributed the improvement very largely to wise legislation. As far as the North of England was concerned, speaking as one who was well acquainted with the Northumberland mines (although doubtless the observation would equally apply elsewhere), there did exist that great regard for human life to which reference had been made. He thought everyone would admit that the instruction which was given under the St. John Ambulance Association had done a great deal to foster this feeling. He therefore welcomed anything which was done by that Association. If England was to maintain her position in the world of commerce, it could only be by having strong healthy workpeople. He had had few opportunities of looking round and gauging the physique of large numbers of the Bradford factory workers. He had had recently, however, the opportunity of observing the factory hands in Dundee. In that town the conditions of factory life were not quite satisfactory. The jute-worker was often a puny, ill-developed person, who compared very unfavourably with the workers outside the town and with the factory hands in other towns. So much so, indeed, was this the case that he had been told it was impossible to obtain recruits for the Army in any large number in Dundee. He hoped that the factory owners of Bradford were all of the type of men that Mr. Mitchell had described. He was sure that he was only giving expression to their feelings when he said that the Conference thanked Mr. Mitchell most heartily for his address.

Mr. Joseph Powell (Tipton) said he would like to emphasize what had been said in regard to the Factory Acts being a success, and that employers were most

faithful and ready to carry them out. He did not know that it could be emphasized in any better way than by pointing out that the premier firms in practically all trades were those who were not only willing and anxious to carry out the Factory Acts, but who indeed had done more than was ever required by those measures. He would refer, for example, to firms like Cadbury Brothers, of Bournville, near Birmingham, and firms like Tangye Brothers, Elkingtons, and an American firm, Patterson's National Cash Register Company, who were offering premiums for competition by their employés for suggestions which would be beneficial to employés themselves. It appeared to him that the wealth of the country was based practically on the care of the working people. Mr. Mitchell had emphasized that idea.

Mr. R. Walls (Burley-in-Wharfedale) said that, as an employé under the Factory Acts for nearly forty years, he would like to support everything that Mr. Mitchell had said. The position of the worker was more comfortable, educationally and physically, because of the passing of the Factory Acts. He would like to say that, as a worker, he appreciated very heartily the efforts of Mr. Mitchell on behalf of the workers, and it was pleasing to hear from an employer that shortening the hours of labour had not been detrimental to trade.

Mr. Mitchell (Bradford), in responding on the discussion, said that what he hoped for was they would more and more get increased production by means of better machinery. They should look for increased production, not to longer hours, but to improvements in the machinery they used. As human invention improved machinery he did not doubt that there would be an increase of production in the same time. Then as education improved, and an increased intelligence grew up, and such legislation as the Factory Acts brought an improvement in the health of the people, they would get more work per man than they had been doing. He thought it was quite possible that in the future, if he dared say it, they might find it possible to still further limit the hours, without affecting wages, because they might have conditions which would enable the employer to do things he could not do now. Any wise Government in dealing with the question would take into consideration all the circumstances of the time and the conditions of trade, and, doing that, they would not force upon the nation anything like hasty legislation. The thing they feared was hasty and ill-considered legislation. They had had a very striking instance of the value of that consultation of interests in this district. Not very long ago special rules were enacted by the Home Office with the object of preventing anthrax. Certain proposals were made by the Home Office. They were considered by a joint committee of the Bradford Chamber of Commerce and the Bradford Trades and Labour Council, representing the employers and the workers concerned. As a result of the consideration, the action taken by the Home Office was considerably strengthened in the interests of the workpeople with the practically unanimous consent of both

employers and employed. The rules were made more workable on account of the practical knowledge which was brought into the question. If the Government proceeded in that spirit, and took into account first of all the general circumstances of the trade, and the local knowledge of both employers and employed, they had nothing to fear from hasty ill-considered legislation. It was a great help to an employer in dealing with such matters as the arrangements of the factory, and especially in what were called "dangerous trades," to have a definite law which he had to obey, and which the workpeople had to obey. It was not always the employer who was at fault. Sometimes it was the workpeople who broke the law. Sometimes the workpeople did things to set at naught the protection which was given them. If there was a definite law forbidding certain things or enjoining certain things, it put into the hands of the employer a valuable power over the workpeople. He was able to say, "These things must be done, because it is the law and not merely my instruction." He was very glad to have that opportunity of speaking to the Institute as a practical man. He could not claim that wide acquaintance with sanitary science which was possessed by many of those who spoke, but as a practical man in regard to factory life he was very glad to give his testimony to the efficient working of the Factory Acts in the Bradford district, and to the valuable results which had been obtained from them for factory proprietors and the workpeople.

THE FACTORY AND WORKSHOP ACT.

By HARRY SMITH,

Shop Hours Inspector and Workshop Inspector, Bradford.

ABSTRACT.

THE inspection of workshops under the Factory and Workshop Act is one of the most important duties put on the inspectors by the sanitary authorities.

In large towns the duty of workshop inspection is usually attached to a special inspector or combined with the duties of inspector under the Shop Hours Act.

The consolidation of the various complicated Acts into one by the Act of 1901 has been a great boon to all concerned.

The line of demarcation between the province of the factory inspector and the inspector of the district council is, roughly, as follows: the factory inspector has complete control of the conditions in factories, and in workshops supervises the hours of labour, whilst the sanitary condition of workshops, workplaces, and retail bakehouses is the business of the inspector for the district council.

An important and far-reaching addition to our duties has resulted from the inclusion of workplaces in some of the provisions of the Act. Restaurant kitchens come under this designation, but it is difficult to see why these are not subject to the same stringent conditions as bakehouses.

Sanitation of Workshops and Workplaces.

The terms of the section dealing with the cleanliness of workshops and workplaces are not sufficiently definite. It would make the work of the inspector much more easy and efficient if there was some definite time fixed for limewashing, as in factories and in cowsheds.

Workplaces also might, with advantage, be subject to the same conditions as workshops.

Curious ideas exist amongst occupiers of workshops as to what constitutes cleanliness. Many cases have arisen where it was objected that it was unnecessary and not customary to wash the floors of workshops and even of bakehouses.

The section of the Act dealing with overcrowding is needlessly difficult to enforce. The occupier of a workshop can be prosecuted by the factory inspector for failing to affix a space notice in the workroom, but if the law is deliberately and defiantly broken by gross overcrowding, nothing can be done by the local inspector but serve a notice to abate the nuisance.

The 400 cubic feet of space during overtime should be made to apply to men's workshops.

The control of temperature in workshops might very well have been left with the district council.

The enforcing of adequate ventilation is very difficult for want of a standard. It is to be hoped that the Secretary of State will adopt the recommendations of the Departmental Committee to fix the degree of maximum impurity which will be tolerated.

The standard of 12 volumes of carbonic acid per 10,000 volumes of air during daylight, and 20 volumes per 10,000 during gaslight, cannot be said to be an unreasonable one.

It is very deplorable that workshops where adult males only are employed are not subject to the sections requiring the maintenance of sufficient ventilation and the drainage of wet floors.

Section 22 of the Public Health Amendment Act, 1890, dealing with the provision of sanitary conveniences, is much more comprehensive than Section 9 of the Factory Act.

Bakehouses.

The sections dealing with the sanitary condition of bakehouses are the most satisfactory in the Act, from the point of view of the district council inspector.

Wholesale bakehouses might, with advantage, as far as sanitary conditions are concerned, be included with the retail bakehouses and put under the control of the Medical Officer of Health.

Indeed, there is much to be said for the putting of the control of the sanitary condition of all factories, as well as workshops, into the hands of the district councils.

The section dealing with the certificating of underground bakehouses has placed a very onerous duty upon the district councils, and as there is no machinery in the Act for letting the occupiers of an old-established

bakehouse down gently, many of these people will, no doubt, suffer serious financial losses. Yet there is no doubt that many, if not most, underground bakehouses are unsuitable, and it will be for the benefit of the public health to close them.

The sub-section, giving the occupiers of underground bakehouses the right to appeal against the decision of the district council, seems a very unnecessary precaution.

HOME-WORK.

The proper supervision of the conditions of home-work is very necessary. Both from a sanitary and a social point of view these conditions are rarely satisfactory.

I strongly incline to view with favour proposals to confine this class of work within my narrow limits.

The provision requiring employers of outworkers to send lists of their names and addresses to the district council twice each year is an entirely wise one, and is of great assistance to the inspector.

The provisions dealing with the prevention of home work in insanitary dwellings, and where there is infectious disease, are also satisfactory.

MISS VYNNE said she would like to say a word for the home-workers, whom she understood Mr. Smith would like to abolish. She was afraid that the prejudice against home-work sometimes rather blinded one to facts. She contended that the mother of children, if she was the right sort of mother, infinitely preferred to do her work at home where she could look after her children. She was told that one of the great difficulties in the Leeds district arose from the neglect of children while their mothers were at factories. If there was any means whereby a woman could earn a living at home, that system ought to be encouraged rather than discouraged. She maintained that the gradual destruction of home life in favour of the factory system was not for the good of the race but for the evil of it, though that was too large a question to be taken up in a brief answer to another speaker. She claimed for women the right to work at home if they were able to do so, indeed she claimed the right of that large army of women who had to earn their own living, to do that they thought best for the health of themselves and their children. That right must of course be limited when the health of others was effected. Their idea of healthiness might be improved, but she would venture to point out that the fairest decision of these matters would not be arrived at by approaching the

question with a general prejudice against home-work. It was scarcely possible for anyone with a distinct prejudice either in favour of or against home-work to be entirely impartial in forming an opinion of the good or evil of any particular class of home-work. She would not touch on matters which were still under the consideration of the Commission appointed by the Home Secretary, but she would like to point out that on an inspection of some 259 women home-workers whose trade had lately been attacked as unhealthy, and indeed it was unhealthy unless carried on with most scrupulous cleanliness, it was found that only five were ill, and a personal investigation had showed that only five were dirty. In defence of the dirty workers she had nothing to say, but the evidence of the chief inspector had shown that the great majority of the home workers were so clean and so healthy that it was not advisable to interfere with them. Some time ago a newspaper, rather given to sensationalism, printed an article on the nail and chain makers, who were described as working under very terrible conditions. The country was told that these women sang at their work—singing was usually a sign of contentment—but in this case they were described as singing "The Dirge of the Women of England." Their work was said to be slavery, degradation, and so on. She (Miss Vynne) was sent down by her society to investigate the facts, and a more generally healthy and happy lot of people she had seldom seen, nor a more contented class of workpeople. The labour was not only light, but it was entirely in their own hands, and they could work when they chose. They could take Monday for washing and Saturday for marketing. The children had sweet, polite manners, were home-loving, well fed and well cared for. The parents objected to factory work because they would cease to have the control over their girls that they had when they worked at home, and the girls in consequence might get into bad company. The young girls themselves did not wish for factory-life. The work was healthy and the smell of the iron was invigorating. The appearance of the workers showed this, their figures were upright and athletic, with broad shoulders and thin waists. One of the women who took part in the deputation to London some twenty years ago on behalf of her trade was now a grandmother, but she was still singing at her forge and extremely enthusiastic about the healthiness of her work. She would like to appeal to Mr. Smith to consider the matter of home-work from the women's point of view. Though, of course, it was difficult for any man to fully realise how a careful mother would feel on the question of letting her pretty, modest, home-loving young girls go beyond her control and into company that might be unfit for them. Factory workers, it must be remembered, were of all classes. A good many factories were well managed, but one could not forget the danger of contamination that young girls in factories must be exposed to. If it was a question of a home-trade being insanitary by all means let everything be done to improve it, and if it could not be improved then it might perhaps be abolished; but surely women should be left at liberty to earn a living by a home-trade which was healthy and sanitary.

Mr. T. F. Cass (Hull) said it was an unsatisfactory state of things that the inspector had no right to order the cleaning of bakehouse floors, which could only be dealt with when they became a nuisance. The bakehouse floor ought to be as cleanly as the walls and tops. He could not agree that the law was altogether perfect in regard to bakehouses. The inspector ought to have power to see that places used as bakehouses were kept in a proper state of repair. Then there was the question of the ceilings. Some tops were simply spars and tiles, and dirt could drop from them on to food in process of manufacture. Then in the overcrowding of workshops we had a very unfortunate state of things. To proceed by way of notice was not of much good, for the time occupied was so long that probably the pressure of work, which was the temptation to overcrowding, had passed away before a committee meeting had been held, and the time for the cessation of the overcrowding had passed. The quickest way to deal with this breach of the law was by intimidation, and by relying on the ignorance of the occupier in regard to the law respecting one's method of dealing with him. In regard to wet and undrained workshops in other trades, such cases could always be dealt with as a nuisance. It was actually a nuisance, but when men were employed they were supposed to be more capable of protecting themselves than women. In regard to the standard for the purity of the atmosphere in factories and workshops suggested by the Special Committee, he thought that the standard set up was not high enough. The amount of carbonic acid gas permitted ought to be much reduced. Ten volumes per 10,000 ought to be the maximum limit during the day and fifteen when gaslight was used. In Hull they were going to try to enforce the provisions of the Home Secretary's order under the Factory Act with regard to sanitary conveniences, in conjunction with the powers given by the Public Health Act Amendment Act, and it might be interesting to Mr. Smith to know that a case would shortly be brought: the summons was already issued. He thought the Factory Department had better powers in this respect under the Factory Act than local authorities had under the Public Health Act. In the latter case they had to have the report of the surveyor, which was unfortunate, because it might happen that the surveyor differed in opinion from the inspector. He knew some districts got over the difficulty by formally transferring all duties of this kind from the surveyor to the inspector, who was appointed an inspector of nuisances. Just a word respecting out-workers. He did not think they should limit their work. There were many people earning a living at home, or contributing towards their own living by shirt-making, blouse-making, and so forth, who could not go to the factory. Many were people who had not been accustomed to factory life: well brought up people in difficulties who had time to do a certain amount of work. He thought that with regard to out-workers inspectors had sufficient powers under the present law, which was in his opinion most wise in regard to out-workers.

Mr. Walter Dyson (Kettering) asked if an inspector of workshops could be regarded as having control of the insides of ovens. In some of the bakehouses in his district the ovens were lined at the top with festoons of soot which was never swept away, and which the bakers refused to sweep away because they said it would interfere with the heating of the ovens. Had the inspector any power to compel that soot to be removed? In the boot-trade some years ago a vast amount of work was done at home, especially in the uppers department, which was chiefly carried on by women and girls. He did not know whether it was beneficial to the trade that this work had been taken into the factories, but he imagined it must have been so in some respects. One of the great evils of home-labour within his own experience, was the fact that children were very largely employed, either in actual work that they might not be employed in doing at a factory, or in running errands. This system of outdoor work therefore deprived children of their leisure time before and after school hours. He would like to ask Mr. Smith whether there was any rule laid down in his district as to the number of water-closets required in factories in proportion to the number of people employed. In his district the factory-owners had for a few years demurred to carrying out the requirements of the local Council. They required, as a minimum, one water-closet for every thirty persons working in the factory. What was the requirement in Bradford?

Mr. Smith (Bradford), in replying on the discussion, said that a remark which he had interjected with regard to home-work seemed to have been that which had caused most discussion. He did not go so far as to say that it should be abolished, but that it should be limited. He made that remark for this reason: The class of home-work with which they most came into contact in Bradford was tailor-work, and the class of people who did this out-work were a drifting class, constantly moving from one place to another, so that when they received twice a year a list of the out-workers, and went to see the premises in which the work was carried on, they in many cases found the persons removed. Often they were Jew tailors who had drifted over from Leeds or some other place, and for a little while set up a home-workshop in their attic, frequently under insanitary surroundings. The women who lived at home with their children, and carried on there some trade by which they gained a living he had not come across in Bradford, except in a few cases. The case of tailor out-workers was one which could be much improved by proper inspection. It was a sweated industry, and the out-work tended to lower the conditions under which others were employed in workshops, and tended also to lower the rate of wages. Mr. Cass had suggested that he (Mr. Smith) had said that the bakehouse clauses of the Act were satisfactory, and he had criticised that position. He had hardly gone so far as to say that they were satisfactory. He was speaking of them in contrast with the clauses dealing with workshops, and the contrast in favour of the bakehouse-clauses was very great. If, perhaps, he had

spoken too strongly it was unintentional, for he did not overlook the fact that these clauses were not perfect; but, in comparison with the clauses dealing with workshops, they were very good indeed. He had had some experience, as Mr. Cass knew, that the bulk of the work of the inspector was done by mere bluff. The people occupying workshops, etc., were ignorant of the powers of the inspector, and they usually did the work suggested by the inspector to be necessary, a simple hint that if it was not done they would hear more about it being sufficient in difficult cases. One of the speakers seemed to have some doubt of what he meant by saying that Section 22 of the Public Health Amendment Act, 1890, dealing with the provision of sanitary conveniences, was much more comprehensive than Section 9 of the Factory Act. What he meant to say was, that the Section of the Public Health Amendment Act included all places where people were employed, while the Factory Act only applied to factories and workshops. In reference to the question raised as to the accumulation of soot on the roof of the oven, he imagined that if there was any danger of the dirt and dust getting into the food as it was baked, the inspector would be able to interfere to cause the soot to be removed as a nuisance. One speaker had enquired as to the number of water-closets required in proportion to the number of employés in Bradford mills. The bye-laws in Bradford required one for every twenty persons in the factory or workshop.

CONGRESS AT BRADFORD.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

SOME ASPECTS OF THE SANITARY CONTROL OF BAKEHOUSES.

By T. FOLEY CASS,

Sanitary Inspector, Hull.

(Associate).

MOST of my hearers will have knowledge of some few of what may be classified as *large* and as *small* bakehouses in which the standard of sanitation is in every respect excellent. These stand out as an irrefutable demonstration that all bakehouses can, and therefore ought to be, kept at a similarly high state of excellence.

Of both the anomalies that have been perpetrated and the advancements that have been made (and both are considerable) in the Factory and Workshops Act, 1901, the climax appears to have been reached in that part of the Act relating to bakehouses; in respect to the former, by the dreadfully absurd mixing up of Authorities: and to the latter, by its sweeping application to underground bakehouses.

The law relating to bakehouses, although good so far as it goes, does not in my opinion go far enough, having regard to the vast influence for physical good or ill the sanitary conditions or otherwise of bakehouses

Note.—The Proceedings of the Conference commenced with an Address by J. Spottiswoode Cameron, M.D., B.Sc., C.M., M.R.C.S. (*see page* 192).

may have on the persons employed, and on the consumers of the articles made therein, and working on the supposition that finality has not been reached in legislation concerning bakehouses, I propose to lay before you a few suggestions as to the line future legislation should take.

The suggestions I wish to make are:

1. The definition of a "bakehouse" should be sufficient in itself, and the difference made between "wholesale" and "retail" bakehouses should be done away with.

2. Special provisions should be made for the proper construction and maintenance in an efficient state of repair of all the floors, walls, and tops of bakehouses.

3. Special provisions should be made for keeping of bakehouse floors free from any accumulation of dust or dirt; and the keeping of registers of painting, varnishing, washing and limewashing should be made compulsory in bakehouses.

4. In order to prevent obnoxious matter being deposited in, or being carried through, bakehouses, sufficient yard-space and secondary means of approach should be compulsory in all new bakehouses, also in others where practicable.

5. The keeping of dogs, cats, or other animals in bakehouses should be prohibited; and no bakehouse should be allowed to be used for any laundry, dwelling, or other domestic or businesss purposes not in or incidental to the process of baking.

6. The owner as well as the occupier should be made liable for permitting a bakehouse which is unfit for use on sanitary grounds to be occupied, where these grounds arise out of structural defects or dilapidations; and power should be given to close any such bakehouses where, in the opinion of the court having cognizance of the case, such a course is necessary to prevent danger to the public health.

7. With a view to removing insanitary conditions from existing bakehouses, and the prevention of such in new bakehouses, it should be made illegal to let, or relet, or suffer to be let, or to commence occupation, or to take over the occupation of any premises as a bakehouse without first obtaining a written permit or license from the sanitary authority in whose district the premises are situate, such permit to be revocable by one month's notice if, on the prosecution by a sanitary authority, a court of summary

jurisdiction is satisfied that the premises no longer comply with the law relating to bakehouses.

The whole of the sanitary control of bakehouses, including *factory-bakehouses*, should be placed in the hands of the sanitary authority in whose district the bakehouses are.

These may appear to be very bold suggestions, but if any apology be needed for submitting them, my apology is that they are based upon practical experience of existing difficulties.

Let us now see if there are any reasons for submitting the above suggestions.

Definition.—Bakehouses, *i.e.*, any places in which are baked bread, biscuits, or confectionery, from the baking or selling of which a profit is derived, fall within the category of "factories" or "workshops" as defined by the Act, to which, of course, no objection need be taken; but there comes something which throws us at once into an unfortunate dilemma. Bakehouses may be either "wholesale" or "retail" bakehouses. A retail bakehouse is defined, but a wholesale bakehouse is not.

Local authorities are given the sanitary control of retail bakehouses, and their medical officer is the proper person to act; whilst the special sanitary control of wholesale bakehouses rests with the factory inspectors; but a wholesale bakehouse, in which no mechanical power is used, is a "workshop," and the sanitary regulation of workshops is in the hands of local authorities.

But when is a bakehouse a "wholesale bakehouse"? Is it a wholesale bakehouse when *anything* baked therein is sold by wholesale, *i.e.*, when part is sold by retail in a shop on the premises and the remainder sold by wholesale? Again, a place in which the process of baking is carried on and from which the goods are not sold in "any place occupied together with" that place, but the whole of which are sold by retail in a shop separately occupied and situated a mile away from the place where the baking is carried on. What is this place? Is it a wholesale bakehouse, or is it only a workshop? It does not appear to be a retail bakehouse (*see* definition).* Where has the line to be drawn? This difference between wholesale and retail bakehouses is, to invert an old saying, a difference without a distinction, which is absurd.

It will also be noticed that the prevention of the use of underground bakehouses, which are not suitable to be used as such, is cast upon local

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* Section 102 Factory and Workshop Act, 1901.

authorities, and this will apply whether they happen to be factories or not. Why is this so? Is it because the duty will be a disagreeable one? or is it because it is a sanitary question? If the latter be the answer, then why was not the whole sanitary control of bakehouses put into the hands of local authorities, instead of the present division and sub-division of control? This unfortunate piece of legislation is bound to result in one of two things: either there will be overlapping of authority, or there will be neglect by both authorities to perform their duty.

It is really difficult to understand how this perpetration has escaped three amending Acts. Surely it would have been much better to have followed the course adopted in the Public Health (London) Act, and placed the sanitary supervision of all workshop-bakehouses under the sanitary authorities; or better still, to have made a clean sweep by taking the course adopted in respect to underground bakehouses, and placed the whole, including "factory-bakehouses," under the control of sanitary authorities.

Construction of floors, etc.—Very common structural faults in bakehouses arise from the methods of construction of the floors and tops. Many of the older floors are composed of brick on edge, or nine-inch square paviours laid in sand; such pavements are very objectionable on the grounds that they do not admit of proper cleansing, for any attempt to wash them simply causes organic matter to percolate into the joints, there to decompose and become, in a very short time, an offensive nuisance. There is the same objection, but of less degree, to wooden floors. The ideal pavement for either ground floors or upper floors of bakehouses is undoubtedly good Portland cement concrete, laid in such a manner as to be easily cleansed by washing.

The only objection to concrete is that the workmen complain of its dryness and heat affecting their feet, causing hardness of the epithelium to such an extent as to give severe pain. This objection is probably a valid one, but doubtless the difficulty could be overcome.

The tops of many bakehouses are made simply of the joists and wooden floor of the story above, or if the building is of one story only the top may consist of a pan-tile or slate roof, open to the spars and tiles or slates, as the case may be. Such tops are, to say the least, very faulty: they do not admit of proper cleansing. There is also a great danger of dust and dirt falling through them into the materials in course of manipulation below; moreover, the limewashing of such tops is of very doubtful advantage, owing to the great probability of "flaking off," and the consequent annoyance arising therefrom. All tops should be plastered, or otherwise properly lined.

If it is necessary to legislate for the proper construction and maintenance of the floors, walls, etc., of slaughter-houses and other places, it is equally important, if not more so, to legislate for these matters in bakehouses.

Cleansing.—It is equally necessary that some direct statutory powers should be given to prevent any accumulations of dust or dirt on bakehouse floors, in addition to the powers already provided for keeping of walls and tops in a cleanly condition.

I regret to say that my experience teaches me that the majority of bakers are not too anxious to keep their bakehouse-floors clean. Of course, the Public Health Acts would cover any nuisance arising from the dirty state of workshop-floors, but to allow a bakehouse floor to become so dirty as to be absolutely a nuisance, does not at all come up to an ideal standard of sanitation.

Yard-space, etc.—The reason for sufficient yard-space and secondary means of approach to buildings used as bakehouses is so obvious that I need not enlarge upon it, except to say that I have known places where the soil and filth from privies have had to be carried through bakehouses because there was no other way.

Animals, etc.—It is very objectionable from a sanitary point of view to see, as one frequently does, a dog or a cat and batch of kittens comfortably housed within a bakehouse, or to see a cat complacently helping itself from a pail of milk which is to be used by the pastrycook.

Such things appear to be extremely dangerous to the public health when we consider that the habit of the cat is to prowl about anybody's ash-pit, and its tendency to contract diphtheria and other diseases communicable to man.

It is equally if not more dangerous to allow bakehouses to be used as laundries, nurseries, or dwelling-rooms.

Insanitary Bakehouses.—The method of dealing with insanitary bakehouses appears to me inequitable, the responsibility being thrown upon the occupier only. It is regrettable that we cannot go directly to the owner of a dilapidated and badly-constructed bakehouse with a demand that he should put the premises in order. Surely it is he who ought to do so; but, of course, no attempt should be made to screen a negligent occupier. In the interests of public health, power should be given to close an insanitary bakehouse, and indeed any other place where the food of man is manufactured by way of trade.

Permit or License.—In support of this suggestion I will, with your

permission, relate two or thee personal experiences which may have many a parallel in the experiences of my hearers.

Some time ago I inspected a large wholesale bakehouse (newly occupied), which had been used as a factory-bakehouse for a number of years, and which appeared to have been constructed by the conversion of a coach-house and stable-yard into a bakehouse, covering the whole of the area in such a manner that the horses used by the baker had to be led through the bakehouse in order to get to and from the stable, the door of which opened directly from the bakehouse. There being no other way for the removal of dung and filth, it had to be carried through the bakehouse. The old pavement of the yard had been partly retained as the bakehouse-floor, as had also the old brick cess-pits for drainage within the bakehouse; and, as if by diabolical intention to increase the insanitary conditions, sewer-gas was carefully laid on to the bakehouse by inside fall-spouts, connected directly to the drain and having open joints.

In another case, a baker took a disused cowshed, situated in a totally unpaved yard, in close proximity to some piggeries, and without sanitary conveniences; erected two ovens therein, limewashed the walls, swilled the old brick floor, and started a wholesale bakery.

Another man took a disused slaughterhouse, treated it in a similar manner, and commenced a bakery.

Again, the occupier of a bakehouse in connection with an eating-house found that he required more kitchen accommodation. So he erected a rough wooden structure over part of his yard, inclosing a faulty gully: walled up his oven-door, broke a fresh one through from the shed, and put the place into use as a bakehouse.

Such places as these may or may not come under the heading of places totally unfit for use as bakehouses, but certainly they are very objectionable, and yet we appear to be helpless to prevent such occurrences. We have already powers similar to those suggested for dealing with slaughterhouses, common lodging-houses, and other places. Why not bakehouses?

Underground Bakehouses.—The most progressive part of the Factory and Workshop Act 1901 is undoubtedly the section relating to underground bakehouses. The real value of this section is at the present time difficult to estimate, but we can safely say that it will be in direct ratio to its practical application.

The general method of construction, or, what appears to be nearer the mark, of the conversion of underground rooms into bakehouses, will be sufficiently well known to you without any description here. Many of these places are low, damp, dark, miserable hovels, which ought to be con-

demned without hesitation; but, on the other hand, there may be many other places which are suitable, or can be made suitable for use.

I believe some attempt is being made to set up a standard of suitability upon which a certificate for the continuation of any underground bakehouse may be granted. This may or may not be a wise course to take, for no doubt each case will have to be considered on its merits; however, I should like to state what appears to me should be required before any certificate is given.

Construction, etc.—All the requirements of the Factory and Workshops Act and the Public Health Acts relating to water-supply, sanitary conveniences, drains, ash-pits, and sleeping apartments should be strictly complied with.

The floors, walls, and tops should be free from dampness and constructed of, or lined with, a smooth impervious material (preferably the floors of cement concrete, the walls lined with glazed brick or tiles, and the tops of cement concrete on steel joists). No wooden casements or matchboard linings should be allowed.

The floor-space of any workroom should not be less than 150 superficial feet; the depth of the floor below the highest ground-level adjoining or nearest to the bakehouse should not be more than seven feet; the height from the floor to the ceiling should in no case be less than eight feet six inches, and the ceiling should not be less than three feet above the highest ground-level, which will be found to be quite little enough for the purposes of lighting and ventilation.

If this arrangement were put into practice, the height from floor to ceiling would work out somewhat as follows:—

Where the depth of the floor below the ground level is	The height from floor to ceiling would be
7 feet	10 feet,
6 „ 6 inches	9 „ 6 inches,
6 „ 0 „	9 „ 0 „
5 „ 6 „	8 „ 6 „

Windows should be provided in all workrooms equal to not less than one tenth of the floor-space, made to open directly to the open air close to the ceiling, and to half the extent of the window area. No window should extend below the ground-level except in the case of windows looking into an open area not less than three feet in width and free from any obstruction of light; also in addition, such other natural means of lighting should

be enforced as will adequately light any part of any workroom by ordinary diffused daylight.

No underground bakehouse should be considered suitable in which it is necessary to use artificial light during any period of ordinary daylight.

In addition to the windows, adequate and suitable means of permanent ventilation should be provided, also means for carrying away any vapours or fumes *directly* from all ovens and gas-stoves into the open air or chimney-flue should be provided.

No system of ventilation should be considered by which there is any probability of dust, dirt, or obnoxious effluvia entering the building, and what is known as through ventilation should be insisted upon.

Protection from sewage.—No drain should be allowed to pass immediately over any part of the bakehouse or oven, and there should be a free space of about two feet between the walls of the oven and any wall of the bakehouse which is backed by the earth above the level of the bakehouse-floor, and all area-gullies should be provided with suitable valves to prevent flood-waters from the sewers entering the building.

Approaches.—The approaches to an underground bakehouse should be by means of properly constructed and efficiently lighted stairs, furnished with proper hand-rails, and, if internal, with proper screen and door above ground level. No step-ladders should be accepted, and no trap-doors or hatchways should be allowed in the ceiling of the bakehouse for any purpose whatever.

Storage rooms.—Sufficient storage rooms for materials used in baking and proper coal or coke bunkers should be provided, which should be entirely separated from any baking-room by means of walls and doors, and should be separately lighted and ventilated.

In other respects.—All the furniture (troughs, benches, etc.) should be easily movable, and there should be no fixed bins, proof closets or other fixtures in any baking room.

No part of the bakehouse should be used for any laundry, dwelling, or other domestic or business purpose which is not incidental to the process of baking. It would therefore be necessary, where dwellings or shops are attached to the premises, to see that they are separately provided with adequate accommodation.

The bakehouse, as regards its situation in respect to proximity of insanitary areas, obnoxious premises, sewers, or other objectionable contaminations, should be fully considered before granting any certificate.

The occupation of baking.—Time will not admit of any lengthy remarks

on the health conditions of the baker's occupation; but a few remarks will not be out of place.

On the authority of Dr. Arledge, Layet, and others, bakers appear to suffer somewhat heavily from their occupation. They are exposed to many incidents inimical to health, such as heat, dust, vapours, disagreeable emanations from the materials used, night-work, and fatiguing movements in heated and badly ventilated rooms, and long "spells" are frequently demanded of them without proper time for meals (especially in the wholesale trade), all of which tend to reduce vital energy, predispose to affections of the heart, lungs, and nervous system, and tend to develop a craving for alcoholic stimulants.

According to Ratcliffe, the mortality of bakers from diathetic (constitutional) diseases is the highest of all occupations; they stand very high in respect to respiratory diseases, and beyond the average in respect to gastro-intestinal diseases, hernia being somewhat common among them. This can scarcely be wondered at by anyone who has watched the baker engaged in the process of kneading dough as he stoops over the trough with his abdomen pressing against its side, and his trunk and arms in the trough, and consider the laborious work that must be demanded in kneading a "batch" of twenty stones of dough in "laps" of four or five stones each. I have often thought as I have watched them, that the baker's lot compares very unfavourably with that of the blacksmith, whose work is, as all will admit, very laborious, but which is, even in spite of smoke and heat, generally done in shops where there is a greater abundance of fresh air.

Everything should be done to assist and encourage the working baker to keep his person and surroundings clean, even beyond that which is required by law, and very much may be done by giving him a suitable place to work in, and placing at his disposal suitable facilities for carrying on his work.

The President (Dr. Spottiswoode Cameron) opened the discussion by saying that this was a subject upon which the Society of Medical Officers of Health had spent a good deal of time. The Society, as they were all aware, had drawn up what they considered to be fair minimum requirements to be insisted upon in regard to all bakehouses. That list of minimum requirements had been sent to all Medical Officers of Health in the country, and he was happy to say that to a very large extent the changes that were going on throughout the country in regard to underground bakehouses were based upon

those recommendations. Of course, the subject of bakehouses generally was very much larger than that of underground bakehouses, and the Society of Medical Officers of Health had been in communication with the Home Office to see whether regulations similar to those applicable to textile factories as to air-space and ventilation could not be issued as an Order of the Secretary of State. That matter was still receiving consideration. They were greatly obliged to Mr. Cass for his practical ideas upon the subject. Mr. Cass viewed it largely from the point of view of construction, but still the information put before them was most valuable. The whole subject of food-preparation was very important, but there was one difficulty which he had felt and which no doubt Mr. Cass had felt. While medical officers or inspectors might lay down lines as to what ought or ought not to be done, they had got to carry their Councils with them. He was not sure, from that point of view, whether the authority which arranged the papers would not have acted more wisely in sending Mr. Cass to the Municipal Representatives' Conference, to tell the municipal people exactly what ought to be done with bakehouses. Here they were all pretty well agreed. What they wanted was to persuade their masters.

DR. R. SYDNEY-MARSDEN (Birkenhead) said the subject was one which had occupied the attention of Medical Officers of Health for some time, and although the recommendations of the central authority were excellent in themselves they could not always be carried out. With regard to *underground* bakehouses (for that was the kind with which they were particularly concerned to-day, and not the modern bakehouses on the ground floor) they must, in dealing with the matter, take up a practical attitude; they must take, not all that they would like to have, but what they could get. Underground bakehouses could not be swept bodily away simply because they did not come up to a particular standard. There was no doubt in his mind that the legislature had intended their discontinuance, and public opinion was rapidly moving in the direction of the abolition of underground bakehouses; therefore, medical officers needed to act carefully in dealing with these places. If bakers were put to a great deal of expense now, a state of things would be brought about which would cause a great grievance and would ultimately lead to a demand for compensation. Medical officers, it seemed to him, ought not to look upon the patching up of these bakehouses as a *permanent* improvement. They could never (at least, in the minds of sanitarians) make an underground bakehouse a proper place for the production of food; at least, that was his view. They had to deal with the subject not only as practical men but as administrators. Therefore, they ought to ask themselves how far they could bring the underground bakehouses up to a condition of usefulness so as to tide them over to a period when the public would demand their abolition. In this way medical officers would serve the public, and still not do a great injustice to the baking trade. It was a trade which was just now in a bad condition, and the new Act meant hardships to

many and ruin to some. Underground bakehouses had been in existence for hundreds of years, and in many cases there was no probability of their being brought up to the required standard. The confined conditions of space, the structural arrangements and consequent difficulties of ventilation were enormous, and all these things required very careful consideration and avoidance of fads.

Dr. Collingridge (City of London) said this was a matter which, from its very nature, must rest with the medical officers of each particular place. He was interested to hear the chairman say that there was a difficulty in educating one's authority. That was a difficulty which must always arise, especially with Medical Officers of Health, for they were always looked upon, more or less, as faddists. The question had been raised as to how far Medical Officers of Health were morally justified in attempting to urge the patching up of the baking trade to a certain standard, knowing that sooner or later these underground bakehouses would all be swept away. That was a practical point which had been thought of in the district to which he belonged. In regard to the preparation of the certificate it had been explained to the owners and occupiers of underground bakehouses that this patching up was a purely temporary measure, that the present Act intended that underground bakehouses should be abolished, and that before long legislation would abolish them; they must look upon the certificate as purely temporary. In fact, on the face of the certificate appeared words to the effect that the bakehouse was in a suitable condition at the date of issue of the certificate, and that any alteration would at once invalidate it. If this view of the question was clearly shown to the owners of this class of property he did not think there would be any hardships, or that any difficulty would be raised about grievances. They understood thoroughly that the expense of conversion would be great, and that the expense of removal would be infinitely greater; and it would be for them to choose between the two. He was in the position of having an exceedingly small number of underground bakehouses to deal with; altogether not more than fifty. Of those fifty, forty were already converted, and he did not think more than ten of the whole lot would be absolutely closed.

Dr. Chalmers (Glasgow) said Dr. Collingridge had raised an extremely important matter, namely, how far they could have underground bakehouses put into a proper condition so as to give a reasonable probability of their being able to repay the outlay made in improvement. In his own district legislation began to touch underground bakehouses six or seven years ago. If there was a probability of the continued existence of any given bakehouse for six or seven additional years, then there was a reasonable prospect of a return for the baker's outlay in any improvements that might be desired. If there was not that probability of continued existence, bakers were advised to get rid of their under-

ground bakehouses altogether. There was one paragraph in page 630 of Mr. Cass's paper which he thought was unfortunate. Mr. Cass, amongst his recommendations, said that the depth of the floor below the ground-level should be not more than seven feet. Now this was a point they ought to get rid of. Another aspect of the bakehouse-question would require more attention in future, and that was whether the definition of underground bakehouses should not be extended so as to include all premises where food is prepared. He had especially in mind restaurant-kitchens. In his opinion there was no class of working-place in such an insanitary condition as a rule. This ought not to be allowed in a place where so much of the food of the people was cooked. If in the next new Factory Act they could have the definition of bakehouses extended so as to include all premises in which food was prepared, something would be done to improve the condition of a place which was not now even a workshop. Another important aspect of this question had lately presented itself to him in a new light. Like Mr. Cass, he thought it desirable that daylight should have access to all bakehouses underground, and when his Committee had decided that it was a reasonable request to ask that sufficient light should be given by which a newspaper could be read, light was promptly projected forty-five feet by prismatic glass. There was, he contended, little actual value in rays projected that distance. "The whole of the sanitary control of bakehouses, including factory-bakehouses, shall be placed in the hands of the sanitary authority." He took that to mean that the conditions they had laid down for underground bakehouses should be made applicable also to factory-bakehouses.

Dr. Coutts (Blackpool) said that one of the difficulties of the Factory Act was that councils were bound either to refuse a license or grant it. The certificate was bound to state that the bakehouse was suitable as regarded construction, light, and in all other respects, and once that certificate was granted there was nothing in the Act to allow councils to revoke it. If something was stated on the certificate to the effect that any alteration would require a further application, the onus on the Authority would to some extent be removed. As Dr. Marsden had said, if they compelled the owner or occupier to carry out considerable alterations requiring the outlay of a considerable amount of money, he would have a certain claim for compensation if ultimately a total abolition of underground bakehouses was enforced by law. As medical officers, they were bound to draw a line. The question was: Where should it be drawn? Dr. Marsden would apparently be satisfied with a minimum expenditure, just sufficient to make bakehouses fairly habitable as workshops. But before they advised their councils to grant certificates they should be satisfied that the places were well ventilated and lighted, and in all other respects satisfactory. The point raised by Dr. Chalmers with regard to restaurant-kitchens was very interesting as well as important. They might give notice to a person that he must not store flour in an underground place in connection with a bakehouse,

and yet at the same time there might be places almost adjoining, used as restaurant-kitchens, where food was prepared and stored, and the authority had no power to do anything. The people themselves thought it was very absurd that all this trouble should be taken about flour in bakehouses, and that the Authority had no power to do anything with regard to the storage of other foods.

Dr. Collingridge (City of London) said he would not like it to go forth from the Conference that the local authorities had had no power with regard to underground kitchens. They were work-places within the meaning of the Factory Act, and the medical officers had absolute power to insist on restaurant-kitchens being kept in a proper sanitary condition.

Mr. T. F. Cass (Hull), in replying on the discussion, said the paper had been taken for what it was worth, and he understood that most of those present agreed with it. Dr. Marsden had put it forth that they should be careful about insisting upon underground bakehouses being put in a sanitary condition, thereby causing expense to the owner or occupier. His opinion was that if such places were not in a sanitary condition, and could not reasonably be made so, they should recommend the authority to close them. That was the intention of the Act, and it should be carried out. If there was any prospect of the general closing of insanitary underground bakehouses, they should not simply let the thing slide on until the change was brought about, but prepare the way for it. If the old bakehouses remained they would be bound to make a sweeping application of any future Act, and that might be worse than insisting upon compliance with the present Act. He agreed with Dr. Chalmers that the definition of a bakehouse should be extended; and he would have it include not only restaurant kitchens but all kinds of places, jam factories, etc., where the food of man was prepared. Those places at which jam and pickles were prepared were sometimes very bad. A better state of things could be brought about even by the application thereto of the present bakehouse clauses. It was fairly admitted that the Factory Act would apply to underground factory bakehouses. Medical officers should, in his opinion, be put in the highest possible position in respect to bakehouses generally. They ought not to have to appeal to the Public Health Act, with all its cumbrous machinery, to abate a nuisance in a dirty bakehouse. It should be sufficient, when his attention had been drawn to it, to write a letter. That ought to be taken as sufficient notice. If nothing came of that the medical officer should be in the position of a factory inspector; he should be able to lay the matter before his authority with a view to legal proceedings.

THE APPLICATION OF THE SALE OF FOOD AND DRUGS ACTS.

By S. G. MOORE, M.B., D.P.H.

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(Member.)

SOME time ago a medical friend engaged the writer in conversation as to the purity, or rather impurity, of the food-supply in this country. It appeared from his conversation that he had given a considerable amount of attention to the subject, and while some of his statements were undoubtedly too sweeping, he appeared to sustain the proposition that large quantities of adulterated food are regularly sold, not only to the detriment of the pocket, but also in many instances of the health of the consumer. He stated, for example, that it was a matter of impossibility in warm weather to obtain cream to which preservatives had not been added. He said that he was prepared to pay any reasonable price, that he had tried several dealers, and that with the help of such apparatus and chemicals as he had in his surgery, he was in every case able to detect the presence of one or other preservative substance.

He complained also of the generally poor quality of his milk-supply. He appeared to have given particular attention to this, and had gone to the length of attending at a dairy on several occasions and purchasing milk which he had seen drawn from the cow. He mentioned that he had been careful to take a part of the total "milking" so as to avoid getting a portion which did not represent a fair sample. The difference between milk bought in this way, and other bought from the dealer in the ordinary manner he assured me was very striking, the one being so much richer that the difference was apparent on mere inspection.

He informed me that in two samples of sugar, he had detected the presence of coal-tar-derivatives.

He also referred to the enormous numbers of cattle and sheep which

arrive in this country from abroad, which are slaughtered at the port of debarkation, but which "never apparently arrive at a butcher's shop."

With the last specified instance we are not now so much concerned, but after making due allowance for exaggeration in the statements of this medical man, there appear to be sufficient and substantial facts to justify some enquiry as to whether or not the purity of the food-supply is adequately secured by the present laws, and by their method of application.

A systematic examination and consideration of the statutes themselves show that they cover almost the whole ground representing their object, and while they may be capable of useful extension in some directions, and perhaps of improvement in others, it would seem to be rather in the method of application, and difficulties arising therefrom that any existing weakness or inefficiency consists.

The following is a good instance of this sort of thing:—

On receipt of a certificate from the public analyst to the effect that an article of food which had been submitted to him in the ordinary course of procedure, contained a preservative, the writer, with a view to avoiding the complication of having to satisfy the Magistrates that the preservative was injurious to health, which would have had to be done had an information been laid under Section 3 of the Act of 1875, caused complaint to be made under Section 6, which, it will be recollected, makes it an offence to sell to the prejudice of the purchaser an article of food which is not of the nature, substance and quality demanded.

He deemed it clear that if, for example, a customer entered a shop, asked for a pint of milk, and was handed a pint of that fluid, containing a dram, or so, of salicylic acid or other delayer of putrefaction, that the food would not be of the nature, substance and quality which he asked for, and that he would be prejudiced by that sale. A deputy-magistrate's clerk sent a message to him after the summons had been issued, to the effect that the information ought to have been laid under the former section, and not under the latter. It was an unpleasant thing to have to go into Court with that dictum in his mind; because the magistrates must accept the advice of their clerk on legal points, and the only means of testing its validity is by a tedious and costly appeal to a higher court. As a matter of fact this issue was not settled by the case, but it was clearly prejudiced by the clerk going into Court with that decision in his mind before evidence or representations had been put forward; and further, it appears undesirable that a point of such importance should lie in the power of a gentleman of that status to decide.

It is beyond question the purpose of the Acts which are under con-

sideration to secure the purity of food, preserved food is not a pure food, and a case ought not to be liable to frustration on what is at most a mere technical quibble.

In the case of Frew and Gunning, which is reported in the fifth series of the Third Scottish Court of Sessions, where after a milk-dealer had been informed that a sample had been purchased for the purpose of analysis, he stated that he could not guarantee the quality of the milk, because it was not the produce of his own cows, it was decided that he was not liable. The mental process by which the legal mind arrived at this conclusion, especially if any regard be held for the intention of the Acts to protect the public, is difficult to understand, except on the supposition that the onus does not lie on the vendor to take care that what he sells is not adulterated, or what is tantamount, to sell an unadulterated article. A consideration however of other clauses shows that such is not the case. It is difficult to suggest a practical remedy for this sort of thing, but that is not a reason why an effort should not be made to do so.

Considerable attention was attracted early in the present year to a case in which an authority, as the result of an analysis which showed that preservatives had been added to an article of food, caused a prosecution to be undertaken. It was admitted that the preservative had been added to the food, and also that the requirements of the Acts had been complied with on the part of the officers of the public service. The magistrate, who was a stipendiary and a barrister, in the course of a long judgment made it clear that he decided the case on the question as to whether or not the preservative was or was not injurious to health. He had before him medical evidence for and against. He also had before him a pamphlet by Professor Von Albrecht,* as well as the report of British and German Committees which had collected evidence on the subject of "Preservatives in Food." In addition experiments bearing on the subject were exhibited to the learned magistrate. As a result the case was dismissed with costs against the public authority.

All this amounts to the fact that a gentleman without medical or scientific training exercised his judgment on a question involving medical and scientific knowledge, and gave a decision thereon. The result of that decision is that a member of the public who goes into a shop and asks for

* A copy of this pamphlet, which was printed on very good paper, and contained plans, diagrams, and illustrations, and presumably had cost a considerable sum of money to prepare as well as to print, was received by the writer some months before the cases now under consideration came on. There was no covering, note, or other intimation at whose expense it was being distributed. This circumstance is somewhat extraordinary, and the writer, as a result of a perusal, formed the opinion that the conditions under which it was prepared, could they be fully displayed, would be illuminating.

an article of diet may with impunity be handed that article mixed with a chemical substance. It may be that the interpretation of the law was sound. The question is whether such a law is not in need of amendment.

A further example of the present condition of affairs is afforded by the case where it appeared, from the certificate of the public analyst of a metropolitan borough, that a sample of milk had been adulterated by the addition of a large proportion of water. The certificate was supported by that of a public analyst for other districts, and the officials at Somerset House also certified that it was largely adulterated by the addition of water, though to a less extent than that shown by the other certificates. The only evidence to the contrary was that of a gentleman who was avowedly the representative of a dairy company. He gave a certificate to the effect that a sample of milk sent to him by the defendant was genuine. Thereupon the magistrate, who was a stipendiary, after making a statement that he had no special knowledge in regard to analysis, and, as a magistrate, he did not understand these things, dismissed the case.

These last circumstances appear to be open to comment in more directions than one. The decision was undoubtedly against the weight of evidence. It did not appear from the published report of the proceedings that the representative of the dairy company proved that the portion of milk which he examined was a sample of the same bulk with regard to which three other certificates had been given showing adulteration. The position of the magistrate, who after stating definitely that he did not understand the case gave a decision, seems very singular. The net result of all these things was certainly not in the public interest.

There is a distinct part of the subject which seems comparatively simple. The time allowed for appeal against magisterial decisions is far too short. From the nature of cases there is a natural and proper reluctance on the part both of the chairman and officers of the health committee or sanitary authorities to take action on their own responsibility, and in three days there is barely time to secure a meeting of a committee at a convenient hour, and still the subject is of such importance that where a decision seems to be unsatisfactory to the responsible individuals, time and opportunity should be afforded for careful consideration of the whole case. It does not seem unreasonable that a whole month should be accorded for this purpose. In many boroughs, meetings of committees are held monthly, and their decision, of course, needs confirmation by the council.

The manner in which the costs of prosecutions are apportioned seems to be another subject which may properly be considered. Prosecutions

undertaken by public authorities in the public interest have some degree at least of similarity to those undertaken on behalf of the Crown. In the latter cases fees for expert evidence are provided for, and the amounts fixed in the schedules. No such provision is made under the Food and Drugs Acts to safeguard the public interests, with the result that it does happen from time to time that heavy fines are imposed upon public authorities in cases, it may be, where owing to technical legal objections being successfully pleaded, defendants who have undoubtedly, in fact, contravened the law, succeed in securing verdicts.

Great advantage would result if a tribunal having an improved means of estimating the value of scientific evidence could be provided. It seems too much to ask from either lay or legally trained magistrates to exercise a sound judgment on every conceivable subject of human interest, and yet that is practically what the present system amounts to. It cannot be questioned that occasionally the results are not altogether satisfactory. The writer believes that very real advantage to the public would result if independent and specially qualified assessors were appointed to assist magistrates in cases involving decisions where technical knowledge is requisite for a just appreciation of conflicting evidence. This principle is established in our legal procedure, *e.g.*, nautical assessors are appointed for cases involving maritime knowledge, and the appointment of medical referees under the Workmen's Compensation Act forms another example.

It may be permitted for a moment to refer to a point which is not included, strictly speaking, in the title.

It is well to recognise the fact that under proper conditions food-stuffs may with advantage be mixed with preservatives; by this means articles of a perishable nature can be preserved, and an abundant supply maintained, with the result of keeping their cost low. Under existing conditions this is not what happens. On the contrary, the dealer uses the preservative to conceal the staleness of his goods and sells them as of, and at the price of, the best quality. It seems perfectly clear that it is right and proper that individuals who desire to obtain food which does not contain preservatives should be enabled to do so, and that the public should be protected from that species of fraud, which consists in selling as fresh a substance which is in reality stale. The report of the Departmental Committee on the use of preservatives and colouring matters in food is well worthy of support, at least, in so far as it advocates the prohibition of the use of chemical preservatives in certain articles of diet, and that where preservatives are added the fact should be plainly stated on the label.

Professor Bostock Hill (Warwick C.C.) said a part of the paper which called for notice was that which mentioned the case of preservatives in food. It seemed to him that as long as medical men came forward and gave conflicting evidence as to the effect of certain preservatives on the human body, so long would they have a difficulty in securing convictions from magistrates. Most of the profession held the opinion that such preservatives should not be found in food unless, at all events, disclosure was made of the fact; but the difficulty was to get effective legislation on the point. He was sure that the recommendation of the Food Committee with regard to milk products would meet with the approval of, at all events, a large part of the medical profession. Then there were the cases raised in the paper in which the decisions of the magistrates were against the weight of evidence. He did not see any way out of the difficulty, except it was by educating the magistrates themselves. He was once interested in a case in which there was no defence at all: it was a case of adding twenty per cent. of water to milk. Just as the defendant was about to plead guilty, the magistrates' clerk stopped him and told him he was not quite sure that he could take that plea; and as a matter of fact, though the man had practically pleaded guilty, the case was dismissed on a technical point. That was a typical instance of what he would call magisterial eccentricity. Another point to which Dr. Moore had given prominence was that relating to expert assessors. He could see a difficulty about that, and in this way: While they might get experts on certain articles, he doubted whether they would be able to find experts who would not be prejudiced in certain directions on some articles which might come under their notice. They all of them, no doubt, held opinions on some articles of food which would not be in accordance with the views of all the profession. There was bound to be variety. If, however, something could be done in the way suggested by the paper, it would be a great improvement upon the present uncertain and irregular mode of procedure.

Dr. J. J. Weaver (Southport) considered it was not quite fair to put all the blame on the magistrates in this question, because matters came before them which it was not always easy on the weight of evidence to decide. He referred particularly to the shrimp-case mentioned in the paper. In that case there was more expert medical evidence against the prosecution than for it, and the magistrate simply gave his opinion on the ground that it had not been proved to him that boracic acid was injurious. The Act allowed a certain amount of preservatives, if it was not injurious. Although he himself was dead against these preservatives, thinking they were most injurious to the community, he did not see what they could do except to insist on the nature and quantity of preservative being stated on the label.

Dr. W. Berry (Wigan) said they ought to give some latitude to the magistrates who viewed cases from a purely legal standpoint. With regard to

Section 3, 1875 Act, mentioned by Dr. Moore, he believed it was perfectly true that magistrates' clerks took this view, and the prosecution were then bound to prove that the preservative added was injurious to health. He thought that this was wrong. If the article sold to people was not of the substance and nature demanded there ought to be a conviction. He himself was engaged in the shrimp-case, and there was no doubt that the shrimps were sold as fresh. Now, they could not have been fresh if boracic acid had been added. At the same time the magistrate, after a very careful sifting of very diverse opinions as regarded boracic acid, found that nothing injurious had been added, and, therefore, he could not convict. Sufficient stress had not, he thought, been laid on the fact that the shrimps were sold as fresh shrimps potted and were not fresh, but had been potted for some time. He held that the people should have a right to get what they demanded, or be told when they did not get it, whether it was shrimps or milk they were buying. It was difficult to prove that anything in the nature of a preservative was injurious, except by experiment, and that was done by Prof. Boyce and Prof. Grünbaum in Manchester. However, the magistrate took a legal view of the case and said he could not convict. The unfortunate part was that the County Council were landed with the costs. It was said that what was being done would mean the destruction of the shrimp-trade. He quite agreed that the magistrate ought to have the opinion of medical assessors, though the experience of county court judges in regard to the Workmen's Compensation Act was not encouraging. The judge was usually a barrister, who decided upon the facts and very seldom asked the medical assessors anything at all.

Dr. J. Howard Jones (Newport, Mon.) said that in his county and that of Glamorgan they had for the last seven years carried on a crusade against the use of preservatives in milk, and more especially in butter. They were trying to educate the milk dealers in respect to the injurious effects of preservatives in milk, and since the report of the Departmental Committee was issued he had sent out circulars to all dealers giving them a summary of the points stated. He was pleased to say that last year he did not get a single sample of milk containing preservatives, whereas seven years ago the practice of using preservatives was almost universal. With respect to butter, not a single sample taken contained the ·5 per cent. of boracic acid. He just mentioned these points to show that reforms could be brought about in spite of the difficulties of administering the Act.

Dr. H. R. Kenwood (Stoke Newington) said he did not think the discussion ought to be brought to a close without someone voicing a protest, which he was sure they all felt, against the so-called "evidence" in favour of the harmlessness of antiseptics in food. When they considered this subject they naturally thought of the harm which the taking of antiseptics might work upon the most suscep-

tible units of the population, viz., infants under the age of one year, and invalids. Everybody was agreed that boracic acid was the least harmful of the preservatives, but taking the dose of twenty grains for an adult person, a full dose for an infant would work out at less than half a grain. Now infants lived almost entirely on milk, and when a summer sample was taken it was often found to contain five grains to the pint, which meant that a child, during the first five or six months of its life, received at least ten grains of boracic acid per day. That could not fail to be injurious. At any rate, experiments upon kittens and other animals did not suffice to warrant the contrary view. Certain experiments had been performed upon human individuals, it was true, but they had been upon *adults* and for *short periods*. What was necessary was what of course they could never get, viz., experiments continued over long periods amongst infants under one year of age, before they would agree with those who claimed that this continuous dosing with drugs was harmless. What they ought to note, too, was the probable effect of the milk upon a person suffering, say, from Bright's disease. He did not think medical men, when they had patients suffering from Bright's disease, cared to contemplate the fact that the milk those patients were consuming was putting twenty to thirty grains of boracic acid into their systems every day. They ought to discuss these points (and legislate upon them) from the point of view of the most susceptible units of the population; and if it could be reasonably demonstrated that it was harmful to a few only, that ought to be quite sufficient reason for legislating against them. It had been shown that these perishable commodities could be dealt with without the use of antiseptics, which were, in fact, simply a cloak for the filthy and unwholesome conditions under which milk was often collected, stored and dealt with in this country at the present time.

Dr. Fisher (Garstang) said he took it that every medical officer of health was agreed that the addition of the preservatives to any article of food was more or less injurious to health. That was a fundamental principle with him, at any rate, representing as he did a rural district. Having gone practically into the production of milk (he was at the present time consigning, he supposed, 120 gallons of milk per day), he could speak with some authority on the practical question of milk production from the farmers' point of view. He did not hesitate to make the statement that farmers did not adulterate their milk. He believed there was a general absence of the practice in the rural district with which he was concerned, comprising twenty-three townships. There was one very important point which they as medical officers of health did not fairly grasp. He meant the conveyance of milk from the place of production by rail to the various towns. Of the railway companies in Lancashire, at any rate, he could say that they did not take that care of milk which so important a commodity demanded. It was a common practice to place the milk cans in a van with, perhaps, a live calf, or dead pig, or fish, whereby the

milk in the course of conveyance was contaminated. He did not for a moment wish to excuse dirty farmers. They were in many cases exceedingly careless, but apart from that, they were greatly handicapped. It was appalling to see how in the laws the interests of the farmer were left in abeyance, and were made subsidiary to the interest of the urban authorities. The milk-farmer himself, did not get that legislative protection which he ought to receive. He had recommended his authority to request the railway companies to provide special carriages for the conveyance of milk to the large towns, and he hoped, through the influence of the Lancashire Farmers' Association and the different branches, that this would be done. The milk traffic is very remunerative, ¾d. per gallon at *owner's risk* being the common charge by railway companies to most towns from rural districts. Financially, therefore, it demanded protection besides being an important article of diet. Passing on to the subject of tuberculosis Dr. Fisher said it was one which ought to be more thoroughly studied by medical officers from the farmers' point of view. In particular he mentioned that a short time ago he received a request from the county medical officer of health to visit a certain farm and report. It appeared that some four months previous, tuberculous milk had been sent from this farm. He was asked to inquire if the farmer had changed his cows. Now, that was a farmer sending away 120 gallons of milk a day. He had to change his cattle every week, or he could not keep up his supply. What he wanted to impress upon them was the fact that by the time his inquiry was made, four months after the tubercle had been detected, the cow would have been removed. He wished to lay special stress that on all milk farms producing large quantities of milk constant interchange of cattle is an actual necessity. Apart from this a suspected, or definitely proved, tuberculous cow will be sold to go and contaminate some other herd and also possibly produce milk. A word for the magistrates. He himself was one of them, and had often heard cases under the Food and Drugs Act. He might say that it was the weight of evidence which told with magistrates. If doctors were so much divided amongst themselves what could they expect of magistrates? Particularly in regard to milk, he himself held exceedingly broad views. In a district where there was a creamery and where milk was bought on its percentage of butter-fat, which he was firmly convinced was the only honest way of dealing with it, it was not uncommon to see samples from a mixed herd of cattle fall below the 3 per cent. And at certain seasons it was practically impossible to get a better per centage, particularly from cows fed on hilly land. He could prove it by instances in the creamery where it was no benefit to the farmer to send the minimum quantity of butter-fat. With cases of that kind coming before him it was no wonder that he held broad views on the subject.

The President (Dr. Spottiswoode Cameron): We should all of us agree that if a cow persistently gave only three per cent. of butter-fat that such a cow

ought to be got rid of. A very important point raised in the discussion was the question of the law. He thought they were all agreed that the stipendiary magistrate, when he was face to face with food-adulteration, with borax, and there was a conflict of medical evidence, was in a very awkward position. On the one hand he was told that boracic acid was perfectly harmless, and then a medical officer of health who was not in practice got into the box and said: "I think it is a dangerous thing, and ought not to be allowed." He (the medical officer) might then put it forward that the presence of the boracic acid ought to be declared, and the magistrate would at once say: "The law doesn't say anything about that." They, as medical officers, ought to insist that all preservatives put into food should be declared on the label in some way. How it was to be done was another matter.

Dr. S. Rideal (London) said he agreed with the chairman's last remark. What they wanted was a declaration, and that could not be settled without further legislation. A short Bill amending the present Act in that respect would be very desirable. As they must be aware he had taken a view with regard to the use of preservatives in milk which was opposed to that of a large number of medical men. He contended that the use of preservatives in limited quantities enabled a large quantity of food-supply to be sold which would otherwise be wasted. Another matter which it was important to bear in mind was that at present they had not sufficient evidence to say whether pasteurised or sterilized milk in which no chemicals had been used, but in which sterilization was brought about by heat, was suitable for the infant. He would like the meeting also to consider whether the addition of preservatives which had an inhibitive or germicidal effect upon those organisms which brought about the souring of milk was not also likewise inimical or germicidal to pathogenic organisms which were frequently present in milk-supplies. For example, the bacillus coli-communis was almost, he might say, normally present in milk-supplies, and this organism might be retarded in its development and its activity arrested by the preservatives used by the dairy trade. They knew, as a matter of fact, that the souring of milk was practically due to this particular organism, and, therefore, there was evidence to support him in the view that by prohibiting the use of preservatives in milk the prevalence of organisms which were more or less pathogenic to man might be accentuated. He had been advocating for some time the standardisation of disinfectants. The use of disinfectants was a matter that ought to come under the control of the health authorities, and it could not be so controlled under the Food and Drugs Act. If there was legislation as to the declaration of preservatives it should include the use of all substances which were meant to arrest the germs, whether in food stuffs or in materials of domestic use.

The President (Dr. J. Spottiswoode Cameron) said he was surprised to hear

Dr. Rideal say that the bacillus coli was a "normal," it surely was not a *necessary* constituent of milk.

DR. RIDEAL replied that he knew of no milk supply without the bacillus coli, though he did not mean to say that it comes from the udder.

DR. W. G. WILLOUGHBY (Eastbourne) said that in his district the clerk had said to the magistrates: "I don't ask you to take medical expert evidence on one side or the other, I submit the recommendations of the Departmental Committee, and they say there should not be more than one grain of boracic acid in a pint of milk." The magistrates took these recommendations when they were explained to them, and he had had no difficulty in getting convictions as regarded liquid foods.

DR. MOORE said that in regard to the propriety or otherwise of preservatives being added to milk, members should refer to the last paragraph on page 641 of the paper:—"It is well to recognise the fact that under proper conditions food stuffs may with advantage be mixed with preservatives; by this means articles of a perishable nature can be preserved and an abundant supply maintained, with the result of keeping their cost low. Under existing conditions this is not what happens; on the contrary, the dealer uses the preservative to conceal the staleness of his goods and sells them as of, and at the same price of, the best quality." As to the difficulty of finding unbiassed experts to advise the magistrates, well, they would not want many advisers. If advisers grew on every bush, as it were, they would not carry much weight and would not be of great authority. But a few gentlemen, who from their standing in the world at large, and in their particular profession, had special knowledge of the subject which was before the magistrate, would be able to give wise and independent dicta which would carry weight with the magistrates. With such a system they would be spared such pitiable results as that which followed in Manchester. That decision meant that Dutchmen were at liberty to come into England and sell as Southport shrimps an article which was altogether inferior to the article which it was supposed to represent. The subject was a difficult one, but that was no reason why it should not be dealt with. If it was difficult then it was worth tackling and putting right. Gross injustice was perpetrated in two or three directions, the health of the public suffered, their pockets suffered, in fact, everybody all round suffered, including the scientific men who were engaged on both sides, and the only person who profited was the fraudulent trader. He would like for a moment to refer to the pamphlet that was circulated by Prof. Albrecht. It appeared to him to be a most regrettable piece of special pleading, and it was rather a pity to see a gentleman of such high scientific attainments taking a very regrettable view of things. He had devoted his undoubted talents towards furthering an industry (a German industry he presumed) of chemical

preservatives for food. The pamphlet was an apology throughout for food preservatives; not that the industry in fact needed an apology. It was a perfectly legitimate industry, but the people should be enabled to know what they were buying, and preserved food ought not to be foisted on to the public as something which it was not.

The President (Dr. Spottiswoode Cameron) said the discussion had shown that they were all of one opinion in this, that when preservatives were added to food the fact should be declared in some way. He was going to ask them, therefore, to pass a resolution asking the Council of the Institute to take this matter into consideration, with a view, if possible, of getting legislation. He did not think the declaration need absolutely state the amount. Perhaps the most that need be stated was the maximum, the amount would vary so much. If a man put in borax he would have to state that there was not more than a certain amount. A declaration should be asked for first, and if more was to be got later so much the better.

The President then read the following form of resolution, which was finally approved unanimously: "That whenever preservatives are added to food their presence, nature, and maximum amount should be indicated on the label, or be otherwise declared."

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 855.

THE REGISTRATION AND INSPECTION OF NURSING HOMES.

By Miss E. MARGERY HOMERSHAM.

(Associate.)

ABSTRACT.

THE nursing home, properly so called, has within the last twenty years become a necessity of the age. Critical operations and long continued courses of treatment require for their success that they shall be carried out, away from the patients' ordinary surroundings, in the quietude and comfort, as well as with the discipline, of a well ordered establishment devoted to the sick. There are many medical and surgical homes excellently well managed, where the sanitary conditions of house and furniture, the food, and care of the patients, leave nothing to be desired; and when abuses do exist in such houses they are generally minor ones, interfering more with the patients' comfort than with their ultimate recovery. The constant attendance of physicians and surgeons renders grave sanitary defects, want of cleanliness, bad food, or serious neglect, matters of impossibility and the very existence of these homes would depend entirely on the satisfaction afforded to the medical profession. On the other hand there are homes for maternity and chronic cases, practically free from professional visits; indeed some of these homes are apparently conducted on the principle of having as little to do with the medical profession as possible. Infants are born, die, or are "adopted," the hapless mothers paying dearly for the scanty attention and secrecy afforded them; the aged and infirm are herded together in such accommodation and with such lack of cleanliness, proper food, and personal attention as renders the evening of life a misery far more pitiable than that of the inmates of any workhouse; and between these two extremes there are many nursing homes where the patients would be made more comfortable, be better fed, and more carefully nursed if the fear of official admonition were kept before the eyes of the proprietors.

The time has now come when owners of nursing homes must realize

their responsibilities, not only as regards their own homes and the patients in them, but as members of the body politic, and agree together to put down with a firm hand the scandals that are constantly arising in connection with their work. Some legislative action will be taken ere long, and the first steps should be initiated by those most nearly interested in the matter. A large majority of nursing homes are owned and managed by women, trained and skilled nurses, who devote their whole energies to their work, and who find it difficult to arrange even for necessary relaxation: still it is with these that the responsibility lies to cleanse their calling from such scandals as have culminated in police court prosecutions, and even, in one case, in the gallows. Over and over again the law has been put in motion to prevent the unlawful detention of lunatics, not under certificates (and consequently not under official supervision), an offence which is often committed in ignorance, and at the express desire of the patients' friends, who dislike the idea of one of their family being certified as a lunatic. These and many other scandals, notably those connected with so-called massage treatment, point to the need of legal registration and inspection of nursing homes generally, and of enactments to enable the authorities to deal with various matters connected therewith. The lines which it seems probable legislation would follow are (1) Registration; (2) Control; (3) Inspection.

Registration presents few difficulties. All houses where medical, surgical, nervous, infirm, chronic or maternity cases are received for payment would be registered and scheduled. Even in existing homes some minimum requirements as to cubic space, ventilation, warming and sanitary arrangements should be compulsory. New homes applying for registration would be more strenuously dealt with. Sufficient cubic space, the best sanitary arrangements, proper heating and ventilation, facilities for cooking and storage of food, and proper accommodation for the nursing and domestic staffs would be compulsory.

Control.—Responsibility for the conduct of a nursing home should be vested in one person (with power to appoint a deputy) who should be answerable for all legal matters connected with the home.

A register of the name, address, and occupation of every patient who comes into the home should be kept, and the name and address of a responsible relative or friend of the patient, as well as the name and address of the physician or surgeon under whose care the case is, noted therein. All chronic, infirm and other cases not under constant medical supervision should be visited at stated intervals by the medical inspector, to whom, if necessary, complaints should be addressed.

A book should be kept in which to enter every birth and still-birth that takes place in the home together with all necessary particulars.

Copies of all certificates of deaths that occur in the home should also be kept and a note made of the place of burial.

These registers should only be accessible to the head of the home and the medical inspector, as their contents would often be of a strictly private character.

No physical restraint of any kind should be exercised over a patient without direct instructions from the doctor in attendance.

Penalties would be enforced for failure to register or comply with the lawful requirements of the inspector, as well as for omitting to keep the various books, altering or mutilating them.

Inspection presents many difficulties, but without it registration would be useless and control impossible. At present, at all events, the authority must be vested solely in members of the medical profession. Some day, perhaps, the mother country may follow the example of one of her colonies, which some years back appointed a medical inspector-general of hospitals and permitted him to choose as his assistant inspector a fully trained English nurse. Later on we may, perhaps, hope to have established in England a hospital board with a department to deal with nursing homes and a body of trained medical, sanitary and nursing experts to exercise the needful authority. At present we must look for an authority among the powers that be, and the officials who (but for their present numerous and arduous duties) appear to be most suitable to take these responsibilities are the county and borough medical officers of health; they have large experience in similiar duties, they are accustomed to exercise authority with tact and discretion, and most important of all they understand the ethics of their profession. These duties would in some boroughs entail an enormous amount of additional work in their departments, but this could be met by the re-adjustment of duties and an increase of staff, for which, of course, those who receive the benefits would have to pay.

It is somewhat difficult to foresee exactly what the duties of inspection would entail, but careful investigation of the registers, personal enquiries as to frequent deaths, still-births and other abnormal occurrences, visitation of chronic cases and others not receiving medical attendance, a general investigation of the premises with an occasional visit to the kitchen and larder would form part of these duties.

This supervision will at first appear very irksome and unpleasant to the owners and matrons of homes, but will not fall so hardly on those who, recognising the necessity, assist in initiating legislation and prepare themselves to submit to the necessary control.

The objections that will be raised to the registration and inspection of nursing homes will be many and various, and cannot be regarded otherwise than sympathetically by even the warmest advocate of legislation. That it will to a certain extent lessen the sense of privacy that patients expect in a nursing home cannot be denied; some will remember a somewhat similar outcry in 1889 against the Notification of Diseases Act, medical men and their patients alike complained that such notification was an infringement of the confidential relationship which had always been regarded as a sacred obligation since the days of Hippocrates. Now, all this has passed away and medical men are often compelled, for the public safety, to advocate the removal of their patients, suffering from certain infectious diseases, to an isolation hospital. In like manner we may hope that objections to the legal supervision of nursing homes will die away when the investigations which will follow such legislation awaken the public conscience and arouse public attention to the unnecessary sufferings alike of newly born infants, the aged and the grievously afflicted, in some so called nursing homes.

Sad to say, the busy and active relatives who place the aged and afflicted in such homes often allow weeks and even months to elapse without visiting them, and when they do arrive, it is almost invariably after a previous intimation has been made, a course which renders the visit useless as a means of forming an opinion as to the care bestowed upon the patient and the amount of comfort he enjoys generally.

Finally, it must be asked, would legislation such as has been suggested in this paper be of benefit to the inmates of nursing homes, would it result in greater care being bestowed on the patients, more attention paid to the sanitary condition of the houses, or would the patients comfort and welfare be imperilled thereby?

Will these suggestions meet with support or condemnation from the medical profession? Will owners of other nursing homes oppose or assist the efforts that will be made to obtain legislation? Anyhow it is hoped some attention will be drawn to a subject that requires grave consideration and frequent discussion before asking for any legal enactment in the matter.

Dr. Collingridge (London) said Miss Homersham had dealt with a most important subject, not only from the point of view of the public, but also of all well-conducted nursing homes. They should be under the control and subject to the inspection of the medical officers. It would be a good thing for the homes themselves, and would undoubtedly tend to do away with scandals that

now existed, and which were exceedingly detrimental to those who were trying to conduct a proper and legitimate business. One of the difficulties of the profession was that it was almost impossible to discriminate between good and bad. If these places were all under the control of the medical officer of health, and a proper register kept, that difficulty would be at an end. There could be no objection on the part of the properly-conducted institutions. Where there was nothing to conceal, suggestions were welcomed and acted upon. The health authorities ought to be able to enter and inspect wherever a nuisance is known or supposed to exist. If this register were obtained, and he thought it might be without any difficulty, the practice of inspection could be properly carried out, and there would be the satisfaction of knowing that the places were in a sanitary condition.

Dr. E. E. Fremantle (Hertfordshire C.C.) said, as one living in a big hospital in London, he was very much interested in the suggestions contained in the paper, but it appeared to him they overlapped a question that was coming forward, namely, the registration of the nursing profession in general. He should like to know to what extent there were scandals going on in nursing homes throughout the country. It seemed to him that a large majority of the nursing homes were carried on by medical men, and if patients knew their medical man, they practically knew what the homes were like. He should have thought, therefore, that the guarantee of the medical man was sufficient. Of course, one would like to know if there was a large amount of irregularity quite apart from the medical question. If not, it appeared to him that the question should be dealt with by a Registration Bill. If there were many nursing homes that were not in connection with medical men they might have a connection with the nursing profession, and it would to a large extent be met, at least it looked to him as if it would, by registration of nurses generally. If the nursing profession was registered in much the same way as the medical profession there would be a penal clause, and consequently the greater abuses would be dealt with at once. He offered these remarks believing that the question would be settled by some other method than by inspection. But if they were to have a system of inspection he should prefer it being in large areas rather than small ones. He entirely agreed that the work should fall to medical officers of counties and borough counties rather than to the medical officers of small borough councils.

Dr. A. Greenwood (Blackburn) said there was not sufficient evidence to warrant an agitation for legislation on this question just at present. The inspection of these homes was already to some extent under the sanitary authorities. Medical officers of health had a right to go into these buildings and investigate a nuisance if it was supposed to exist. They ought to guard against too much legislation, unless there was more evidence than existed at present that legislation was required.

Dr. Fisher (Garstang) said that if legislation was brought about a distinction should be made between the medical and surgical homes and the so-called nursing homes. It might be taken for granted that the home which was practically conducted by a medical or surgical practitioner will be well looked after and controlled. The medical man should be sufficient guarantee; at least, he hoped the profession at large would be free to acknowledge that it was. On the other hand, there were nursing homes where nurses were lodged at certain times and there drafted out. Those homes were entirely different from the homes connected with a medical man. One knew how very important it was that nursing homes should be in every way sanitary, not only with regard to the conditions existing in the house, but with regard to the nurses themselves.

The President (Dr. Spottiswoode Cameron) said he took it that the paper dealt simply with Homes for resident patients. He confessed that he thought most of them were not particularly anxious to have a lot of new work thrown upon them. They found a great difficulty in getting through the work they already had to do. At the same time, Miss Homersham had made out a good case for some kind of inspection, and possibly medical officers of health in large towns might be willing to undertake a general supervision of the class of home alluded to. They would all feel, of course, that in the case of a home kept by a surgeon for his own cases very little inspection was necessary. For his own reputation he would take care to have everything properly done. He was just the man who would say to the medical officer of health if he was in a difficulty, "Will you help me out?" But there were homes run as trading concerns where patients were taken in and often no medical man was called in. They were not under the control or supervision of any particular medical man. It was for the inspection of these, he presumed, that Miss Homersham pleaded. Whether medical officers would offer to undertake inspection or not was another matter.

Dr. Reid (Stafford) corrected the impression that medical officers had a right of entry to nursing homes. At the present time a medical officer had a right of entry only if he had reason to believe that a nuisance existed on the premises. He could be refused admission if the occupier of the home thought fit; in which case the only remedy the medical officer had was to go to a magistrate for an order. He had then to prove to the magistrate that he had reason to believe that a nuisance existed in the home, and how in most cases could he prove that without the power of inspection?

Miss Homersham, in replying on the discussion, said she had no intention of bringing nursing institutes within the scope of the paper. The Homes she alluded to were those which existed in all parts of the country, where chronic and maternity cases were received; where the aged and the infirm were placed

for some payment, large or small, and left entirely to the care of the proprietors, who, in a great many cases, were not trained nurses. She knew of three homes where the proprietor had no nursing knowledge whatever, except what had been gained by long continued contact with, she could not say care of, the aged and infirm. Occasionally, when a bad case came into one of these homes, a more or less trained nurse was called in to take charge, but the majority of the patients were chronic invalids or very old people. Again, there were homes where maternity cases were received. She need only just mention the terrible calamity and disgrace which recently fell upon the nursing profession when a woman who kept a maternity home was hanged for infanticide. It was from scandals such as these that she desired to cleanse the nursing profession. She would wish to have all nursing homes under inspection; to have some authority to whom complaints could be made. She did not agree with Dr. Collingridge when he said that all medical and surgical homes in the West End were practically run by the surgeon who used them. But these homes were almost free from abuse, as she had said in her paper, still she did not think it would be at all right that one nursing home should be exempt from inspection and another should be subject to it; consequently she would say: Put all under authority. With regard to the right of the medical officer of health to enter in the case of a nuisance arising, his power was the same as in a private house, and little help could be expected from him beyond dealing with an actual nuisance, and it was very difficult to say that the improper care of patients would amount to a nuisance in the eye of the law, or in the eyes of neighbours who would have to make complaint.

TRAMPS AND THE PART THEY PLAY IN THE DISSEMINATION OF SMALL-POX.

By JAMES ROBT. KAYE, M.B., C.M., D.P.H., &c.,

Medical Officer to the West Riding County Council.

(Fellow.)

THE present time, when the country is emerging, one hopes, from the the recent wave of small-pox, affords an opportune occasion to emphasise the part played by tramps in the dissemination of this disease.

As sanitary officials or members of Authorities charged with the protection of the public health many of us have fresh in our minds concrete examples of the importation and re-importation of small-pox into communities which would have been practically safe from attack were it not for the tramp element.

Experience of this kind in the recent prevalence of small-pox has only been another repetition of the lessons of past years. In 1893, Dr. Armstrong showed that of 63 towns invaded by small-pox no less than 37 owed the first importation of the disease to vagrants, and many of them suffered re-introductions by the same channel, *e.g.*, in Blackburn 18 times, Nottingham 25, Keighley 15, Warrington 12, and many others.

This year the Authorities at Accrington investigated the same point and sent out a circular to 198 towns asking how small-pox was first introduced into their respective areas during the recent prevalence. Out of 138 replies received, 100 definitely attributed the introduction to visitors of the tramp class. In times of general prevalence the continual re-introduction of the disease by tramps is the most disheartening experience which the sanitary officials of every large town have undergone. At Sheffield, out of 28 importations of small-pox between November and May last, no less than 21 were brought about by tramps. At Huddersfield, 8 out of 13 invasions were directly attributed to tramps, while at Barnsley

Dr. Sadler tells me that all their 46 cases could be traced back to visitors of the lodging-house class.

I had prepared some diagrams illustrating the part played by tramps in the dissemination of small-pox, but the experience seems to be so common, that there is no need to dwell upon it further.

It is when we come to consider what measures are possible for reducing this propensity of the tramps to act as a dangerous menace to the public health, that we meet the real difficulties of the question.

Under the term "tramp" I include (for the purpose of this paper) the whole of the nomadic population who resort to the casual wards of work-houses or to the ordinary class of provincial common lodging-houses. Of course in the latter premises there is often some proportion of permanent lodgers, whose movements are usually confined to the particular town or locality. But I think we might even group them all together, because they frequently act as intermediate hosts, receiving the infection from the birds of passage with whom they mix, conveying it to the succeeding wanderers, and also to the regular members of the community.

It is not for us as sanitarians to deal with the social conditions which necessitate or admit of the existence of the tramp class, nor to propose schemes for their abolition. That is a Utopian idea, which has received the attention of philosophers and legislators in all ages. Amongst the Greeks and Romans, according to the laws of Solon and Draco, a conviction of wilful poverty was punishable by death.

In our country, in the 14th century, vagrants were condemned to prison or confinement in the stocks, yet the country was over-run with them. Subsequently the law made a distinction in favour of the aged and impotent poor, who were allowed to beg in the localities in which they were born or had resided for three years. To-day, the class of persons whom we have agreed to term "tramps" includes not only the beggars, vagrants, loafers, ne'er-do-wells, and those who are industrially and physically deficient, but it also comprises itinerant dealers, hawkers, jobbing workers, as well as *bona fide* out-of-works seeking employment. The classification might be extended, but it is not necessary for our purpose to do so. Nor need we enquire how much of honest poverty and penniless industry is to be found amongst either class, though experience suggests that these form but a small proportion.

How may we find a means of checking the sinister influence of the tramps on the public health? In numbers they are comparatively insignificant, but their numerical strength is not an index of their influence in spreading disease nor of the difficulty surrounding their supervision.

From enumerations which are taken every six months by the County Police of the West Riding * there are on the average some 1,100 tramps and vagrants in a population of 1¼ millions. Of this number less than 20 per cent. are found in the tramp wards, the rest frequenting common lodging-houses. Taking the whole country, the number of tramps and vagrants is estimated at about 36,000.

It is scarcely credible that so small and undesirable a section of the public should be allowed to exert so baneful an influence in times of epidemic, taxing the resources of a great part of the sanitary officers of the whole country, and causing an expenditure on the State wholly out of proportion to their numbers.

It is not that these persons are, of themselves, more liable to sickness than others; there are whole communities who are certainly no better vaccinated than the rank and file of the tramps. The whole point is that when once a tramp receives infection he rarely comes under official observation until he has been in close contact with numbers of his kind, who in the meantime have dispersed in all directions, probably carrying with them seeds of disease, with which they in turn will infect other wanderers before their own progress is checked.

Those who have tried to follow up and arrest such a course of events will need no convincing that the present sanitary machinery is incapable of adequately dealing with the problem. Very little reliance can be placed upon the accounts given by tramps of their past wanderings or future itinerary, and the helplessness of the law is often disheartening.

The provisions of the Public Health Act with regard to common lodging-houses are not sufficient to meet the difficulties we are considering. The schedules which the keeper may be required to furnish under Sec. 83 are often of little value. The professional tramp changes his name as often as suits his convenience, and gives whatever account he thinks proper of his past wanderings or future destination. Section 124, giving the sanitary authority power to order the removal of an infected lodger to hospital usually operates when the small-pox tramp has become too obviously infected to proceed further on his disease-distributing march.

The necessity for further legal powers was well recognised on the occasion of the last epidemic some ten years ago; but nothing has yet been done in that direction, and unless the matter is strongly and continuously pressed forward by sanitary reformers we shall be left to fight the next

* It should be mentioned that the "tramp census" is taken at night and does not embrace the large county boroughs, nor boroughs having their own police force.

epidemic with the same defective powers. In 1894 the London County Council called a conference of the sanitary authorities in England and Wales to consider this very question. Representatives of more than 100 sanitary authorities attended, and a number of resolutions were adopted indicating the directions in which increased powers were desired by local authorities in controlling common lodging-houses, &c.

These directions included powers for compulsory disinfection, detention, or re-vaccination of tramps suspected of having been in contact with small-pox infection. The notable feature of these proposals is that they involve power to deal with the tramp himself, whereas our present powers are chiefly confined to supervising the lodging-house keeper and his premises, and do not touch the tramp himself prior to actual illness.

In proposing such measures for regulating the healthy tramp, we are met at the outset by opposition on the ground of interference with "personal rights," the sensitive bugbear which confronts us on this matter in nearly every direction. I contend that where the action and manner of living of the unit or small minority (in this case the tramp) are such as to endanger his own welfare and the public health, it is not unreasonable to suggest some restrictions.

When once small-pox is introduced amongst tramps it requires the most drastic powers to arrest its spread, owing to the fact that in all their domiciliary actions they are as closely related as the members of one family. It really seems anomalous that the Government should deem re-vaccination necessary in the army, navy, and postal services, and yet allow the vagrant to wander about in times of epidemic without let or hindrance.

There is ample precedent for the imposition of restrictions by the State on particular sections without any real curtailment of that liberty which is so dear to every "Britisher." It is at present an offence to carry on certain trades unless duly sanctioned and supervised by the authorities, and why should not "tramping" be recognised as an occupation attended (in times of small-pox prevalence) with danger to those who follow it, and to the country at large?

The assumption that the individual has the right to carry on his occupation of tramping without taking all due precautions against spreading disease through the country, is not only morally false, but it is in opposition to the spirit of social and statutory law.

I am aware that to compel the re-vaccination of a vagrant against his will is a proposal which would raise great opposition in certain sections of of the public. The "personal right" element in the problem of civic

sanitation has too long been a barrier to progress, and when, as in this case, it is reinforced by anti-vaccination arguments, the chances of carrying compulsory vaccination of tramps seem doubtful.

If, however, the force behind the Government (the great tax-paying public) could be brought to realize the anomalies of the situation, we should soon have extended powers. In the recent prevalence of small-pox some 12,000 cases have occurred in the provinces (since January, 1902), and experience all over the country shows that the most subtle agency of distribution is not to be found in the close commercial intercourse of our communities, but in the wanderings of the relatively insignificant number of people whom we designate "tramps." The expenditure of public money under the head of small-pox prevention has been enormous, and no estimate can possibly be made of the disturbance of trade, of public safety, and of the routine work of sanitary authorities.

Those stationary communities, who are notoriously ill-vaccinated and rely chiefly on the advantages of local sanitation to protect them from small-pox ravages, cannot rationally oppose the suggestion for stricter supervision of tramps. From the very nature of their wanderings, the latter class cannot secure the cardinal advantages of sanitation, and, as we have seen, they act as the main channel by which the dreaded disease can be conveyed to these stationary unvaccinated populations.

Various suggestions have been made from time to time for instituting during periods of epidemic disease, a system of passports which would enable the Authorities to trace the movements of any particular tramp. But such schemes would be defeated by their intricacy and detail, unsuited to the class of person concerned, and there would always be fraud, exchange of passports, etc.

We are, therefore, reduced to the conclusion that what is required are direct powers to deal summarily with the tramps themselves, to secure the following ends when desirable :—

(1) Vaccination or re-vaccination of any such person *exposed* to the infection of small-pox.

(2) Disinfection of the person and clothing.

(3) Detention of the present inmates of infected common lodging-houses and refusal of new admissions.

(4) Complete closure of common lodging-house where necessary.

In order to make the proposals less unpalatable to those who on principle are opposed to measures of coercion, I should be satisfied if it were so arranged that the powers referred to be only brought into existence as occasion demands, say by an Order of the Local Government Board,

applicable over such area and for such time as they might deem proper. I have in mind the machinery by which the Board of Agriculture issue Orders under the Contagious Diseases (Animals) Act, imposing drastic restrictions on certain areas and conferring special powers on Local Authorities.

Moreover, it would be possible to reduce the violence of the powers for compulsory re-vaccination by offering to the person the alternative of submitting to thorough disinfection and detention in quarantine.

I do not propose on the present occasion to enter into the subsidiary questions of compensation, &c. I merely express my conviction that the above powers are absolutely necessary to sanitary authorities if they are adequately to uphold the responsibility of protecting their populations from small-pox in times like the present. Any expenditure necessitated by such powers (*e.g.*, compensation) would be far preferable to the enormous loss inflicted on the community under the present system. It seems to me that it ought not to be beyond the resources of modern government to provide the machinery required without in any way sacrificing our reputation as a nation for liberty and freedom.

I would therefore propose the following resolution:—

> "That in view of the recurrent outbreaks of small-pox, largely contributed to by a certain class of society, the Government be requested to take into consideration the necessity for legislation to deal more effectually with those resorting to common lodging-houses and workhouse tramp-wards as a constant and dangerous element in the propagation and dissemination of small-pox."

(*For discussion on this paper, see page* 663.)

NOTE.—Resolutions passed at Meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 855.

THE SMALL-POX OUTBREAK AND ITS LESSONS.

By E. DRYDEN FENWICK.

(Associate.)

(ABSTRACT.)

ONE noticeable feature during the recent epidemic was the want of isolation hospital accommodation, and many sanitary authorities were entirely dependent upon their neighbours; a proceeding far from satisfactory to the more provident body. So expensive has this mistake proved that I do not fear a repetition of it.

With the "conscientious objector" out of the way, however, I do not see the need for small-pox hospitals.

The following facts, I think, will go a long way to prove the power of vaccination to render persons insusceptible to small-pox.

The only member of our staff to contract the disease was a servant who objected to being vaccinated.

She did not come in contact with the patients as other members of the staff did.

She was the only one who refused the protection.

We had vaccinated patients, but those who were unvaccinated suffered from a more virulent type of the disease.

We had no patients who had been vaccinated on more than one occasion.

One of our patients was the only unvaccinated member of a large family and the only one to contract the disease.

Compulsory vaccination of Post Office officials has been attended with great success. Cases of small-pox are unknown among these Government servants.

That they are exposed to infection cannot be gainsaid, for I know of a parcel of infected clothing being posted, which must have passed through scores of hands before being handed over to be destroyed by a sanitary inspector.

The system of vaccination found to answer so admirably among one body of people must recommend itself to every fair-minded person for general adoption.

Without doubt our trouble has been brought upon us by the anti-vaccinator (I class adults vaccinated only in childhood as anti-vaccinators). He refuses protection, contracts the disease, and becomes a burden upon the ratepayers. He then makes a further call upon the public purse by claiming (and in most cases receiving) compensation for a self-inflicted injury.

We are well acquainted with the part played by another section of the community in spreading this disease.

I allude to that army of wanderers of no fixed abode with whom vaccination is as unpopular as the bath. I find reliable information as to their antecedents is not readily given by these people, and thus the difficulty is further increased.

Is it not lamentable that a disease so easily prevented as the one under notice, should be allowed to work such ravages? Knowing, as we do, the remedy, we must do all in our power to apply it. I consider this an opportune time to forward the pro-vaccination movement, and I hope some member or associate attending this congress will move a resolution to the effect that compulsory vaccination and re-vaccination are necessary. Such a resolution forwarded to the right quarter ought to go a long way towards ridding us of one of the most loathsome diseases from which man ever suffered.

[*This discussion applies also to the paper by* Dr. James Robert Kaye.]

Dr. Collingridge (London), speaking of the relatively small number of tramps in the country (estimated at 36,000), said we in this country had an extraordinary idea of personal liberty to allow this small number to wander about the country carrying small-pox wherever they went. If there was one thing clearly established with regard to the dissemination of small-pox it was the enormous influence that the tramps' population had had upon it. That was true not only of the tramps on the road; it was true of the tramps on the canal; and principally, they would hear later, it was true of the tramps on the high seas.

Wherever they had a wandering population, with a love of personal liberty, which amounted to license, nay more, to an absolute disregard for the safety and comfort of other individuals, so long would they have this trouble. Now, whatever opinions they might have with regard to re-vaccination, and he took it there were still some gentlemen who refused to believe in the efficiency of vaccination and re-vaccination, they ought to have no sentimental objection at all to dealing with people who would not work, who did not intend to work, and who under any circumstances ought to be treated as dangerous to the public. "If any will not work neither let him eat"; and certainly the man who would not work should not be allowed to be a danger to other people. Sooner or later they would have compulsory vaccination in this country: he thought they would have compulsory re-vaccination, but the time was not yet. The country had not yet learned that the feeble vacillating policy during the last few decades of people who ought to know better had landed the country in this position; that the Government, finding that they were unable to please everybody, were obliged to accept a compromise and to bring into existence what, forscoth, was called the "conscientious objector." That was only one difficulty. The other difficulty was this: We talked in this country about compulsory vaccination. Now, compulsory vaccination was a thing that never had obtained in this country, and until opinion was very much changed there would be a considerable difficulty about introducing it. What he said was that the whole of the objection against vaccination and re-vaccination of tramps arose first of all from the individuals themselves, who must be disregarded, and secondly from prejudiced communities. Their opinion was not worth having. He would urge first of all compulsory vaccination and compulsory re-vaccination of all individuals, especially of tramps and vagrants without means of support.

Dr. Moore (Huddersfield), in the absence of Dr. Kaye (West Riding C.C.), seconded the resolution, and said that Dr. Kaye, in the course of his paper, had shown that the total number of tramps and vagrants was probably not much greater than 36,000, and in the recent prevalence of small-pox some 12,000 cases had occurred in the provinces since January, 1902, which meant that every three tramps had succeeded in causing one case of small-pox in a population of something less than forty millions. These tramps and vagrants belonged to such a class, to such a low stratum of society; they were so objectionable in their habits and customs that for their own sakes they would be better under control, to say nothing of the benefits such control, or dragooning, would confer upon the communities whom they infested. It was not only that they were a danger to public health, but they knew from a perusal of the daily newspapers that it was amongst this class of individuals that the perpetrators of the most dastardly crimes, which debased our civilization from time to time, were to be found. The only thing that occurred to him by way of serious comment upon the resolution was that perhaps it did not go far enough,

although he had no doubt that Dr. Kaye had been deliberate in leaving it in its present general form. Dr. Kaye considered that the Government ought to take into consideration the necessity for legislation to deal more effectively with those resorting, and so forth. That brought into his mind a point for consideration. It seemed to be recognised amongst many sanitarians and to be accepted as a fact, that it was hopeless to expect that the legislature would in the near future re-impose compulsory vaccination, but as to whether they would be able to secure a general law requiring re-vaccination at any age—well, that might be so. He would submit to them that if they did not hope to get what they believed to be right and proper, it was no reason why they should not continue to advocate it, to maintain a firm front and to affirm under all circumstances and on all occasions what they believed to be right and proper. In this matter the present Government had been most re-actionary in acting according to what they conceived to be the most expedient principle at the time; still, it was re-actionary and wrong. He took it that medical officers, without exception, would agree to that.

DR. HERBERT WILLIAMS (Port of London) said it must be granted that small-pox in this country did not arise *de novo*, that it must be introduced from abroad. He believed that the recent outbreak in London was attributed to, if not actually traced to, a person who had come from Paris. He should like to see some mention in the resolution of going back to the origin of the thing. Coming into the Port of London there may be a case, or several cases of small-pox on the vessel. And after he had disinfected all that he could he was still met with the difficulty of detention. The passengers, many of them foreigners, land and go into lodging houses, where, after about ten or eleven days, they displayed symptoms of the disease, and so disseminated it throughout the country. The Local Government Board had by an Order given them certain powers to deal with plague, yellow fever, and cholera, but the powers they possessed of dealing with small-pox were only those given by the Public Health Acts. By the Plague, Yellow Fever, and Cholera Order they had power to detain on board or in hospital for forty-eight hours anyone who might possibly develop either of the diseases. Under the Order also very heavy penalties could be imposed on people if they did not give correct addresses of where they were going. He advocated the extension of this clause to cases of small-pox. The Local Government Board had the power under the Public Health Act by the mere scratch of a pen to put the same powers in force with regard to small-pox, as existed in the case of plague, yellow fever, or cholera. Wherever possible now they took the names and addresses of persons and sent them out to the medical officers of health of the districts to which the persons were going, and he should like to urge the desirability of the Local Government Board putting small-pox on the same footing, and, in addition, giving powers to vaccinate and re-vaccinate compulsorily persons on board before they were allowed to land.

Mr. Harding Roberts (Clerk to the Holywell District Council and Board of Guardians) supported the resolution, saying that the Government were largely responsible for the creation of the tramps that now perambulated our country districts. Recently the Holywell Guardians had a case of small-pox imported into their workhouse, and that was by a tramp. A census had been kept of the tramps that came into the workhouse, and it was found that from seventy-five to eighty per cent. of them were men who had been discharged from the army. Therefore the Government had the responsibility of providing for those men who went about the country and carried with them this objectionable disease. The general experience, at any rate, of those concerned with administering the Poor Law was that the Government had a responsibility in regard to this matter, and that they should legislate. It had been suggested that legislation should be directed to the formation of Labour Colonies, to which these men who had no occupation could be sent. At present they were not only objectionable in themselves, and made themselves chargeable to the rates, but they imposed a heavy financial responsibility upon the localities where they spread the disease. He supported the resolution, believing that the Government had a duty in this matter. They largely contributed to the spread of the disease, and they ought to legislate in particular so as to prevent it.

Dr. F. J. Sadler (Barnsley) said he was delighted to hear Dr. Williams say that merely by the scratch of a pen the Local Government Board could, at all events, give the port authorities power to isolate and detain suspected cases of small-pox. His experience at Barnsley during the last six months had shown him that if they wanted to deal effectually with an outbreak of small-pox they should, in addition to having the power to vaccinate and re-vaccinate, have the power of detention. That was practically what they in Barnsley had succeeded in doing; but then, of course, they had no legal power to detain. They ought to have the legal power to detain and, if it could be got by a scratch of a pen, that would be much easier than by legislation. Recently there had been sent round to all medical officers of health two resolutions, proposed by one of the Country Boroughs, in which this identical thing was proposed: that if the Government would not grant compulsory re-vaccination—and he did not suppose the present Government or any other Government in the near future would dare to grant such a thing—then at least they might, in the case of an epidemic of small-pox, grant legal powers for the detention of "contacts" in isolation. He should like very much to know how the authorities persuaded the "contacts" in Leicester. In Barnsley, at any rate, it was practically impossible to persuade "contacts" to remain in their houses for a fortnight. In fact, it was only by a piece of bluff on the part of certain very efficient members of his staff that they succeeded as well as they did in isolating their first lot of "contacts." He urged that some clause should be inserted into the resolution asking that powers for compulsory

detention in lieu of re-vaccination be given to sanitary authorities in times of small-pox epidemics.

ALDERMAN HINDMARSH (Gateshead) said the Tyne Port Sanitary Authority very much wished for powers such as those indicated by Dr. Williams. They wanted more stringent powers to deal with vessels when they arrived at the mouth of the Tyne, and, with Dr. Williams, he thought the powers could easily be obtained. They already had certain powers to deal with plague, yellow fever, and cholera; and small-pox ought to be included in the same list. It was one of the most difficult diseases to deal with. As to the tramps, it was his opinion that they ought to be dealt with in a way that would prevent them spreading small-pox throughout the country. Some person had spoken of workhouses. The first case they had in Gateshead was that of a tramp landed in the workhouse, and the result was that they now had fifty or sixty cases in the borough and the cost had been considerable. If they could do anything to prevent tramps going about the country a great good would be done. A few years ago Guardians were given power to keep tramps two nights and a day. That very action in Gateshead reduced the number of tramps by one-half.

DR. J. HOWARD-JONES (Newport, Monmouth) said that if the "contacts" were vaccinated it was necessary that they should be detained. If a "contact" was vaccinated and sent away and was lost sight of he might have modified small-pox and be a far greater danger than if he had gone away unvaccinated. If unvaccinated he might get a bad attack of small-pox and seek medical assistance. So that if they simply asked for power to vaccinate "contacts" and did not have power to detain them a very serious door to danger might be opened. He referred more particularly to "contacts" vaccinated three or more days after exposure to infection.

DR. CHALMERS (Glasgow) said that if the resolution were passed in its present form he seriously thought it might cause some difficulty. As they might know, Glasgow two years ago suffered to a considerable extent from small-pox. At that time the disease spread irrespective of the part played by the common lodging houses. They did have an outbreak, however, several years before, when it was almost exclusively confined to the tramp element. By means of bribes they then induced large numbers to be re-vaccinated, and to such an extent that when the epidemic occurred two years ago the lodging houses were practically free. If the resolution were carried in its present form its use and scope would be restricted. It would not enable them to deal with the wider question suggested by Dr. Williams. He should like to see the Local Government Board grant power to local authorities to define certain areas for such purposes. This proposition was limited to tramps only. What they wanted was to re-vaccinate everybody; not only tramps, but the artisan also. He did not

know whether in England there was a corresponding power to one which was possessed locally by Glasgow enabling them to define an area for definite purposes. He did not think it applied to the subject of vaccination. It seemed to him that the resolution ought to embody a demand that the Local Government Board should grant to local authorities power to mark off a district within which re-vaccination of everybody exposed to infection could be carried out. Then the restriction of tramps would be made applicable to everybody, for small-pox would spread irrespective of the part played by the tramp.

Dr. E. Walford (Cardiff) having recently had to deal with a short outbreak of small-pox, emphasised the great danger which large urban and other districts experienced from the tramp element. Although no doubt they would all desire to have compulsory re-vaccination of the whole community, it seemed to him that the first step to take would be to induce the Government to compel the re-vaccination of tramps, certainly in casual wards. His experience was that outbreaks in many cases in the large towns had been due to these tramps passing through the casual wards from one place to another. In the absence of compulsory powers he could not conceive why the vaccination authorities should not offer sufficient inducements (it would not require a very large inducement) to a tramp to consent to be re-vaccinated. With regard to what had been said about the discharged soldier his experience was exactly the contrary. A short time ago in Cardiff at a seamen's lodging-house, or kind of working-man's home, a man who had developed small-pox came in. Curiously enough at that time the place was almost entirely inhabited by men who had been discharged from the army. There were about 150 of them there at the time, and not one of them contracted small-pox, although most of them had been in contact with the man for several days during the period the rash was out. He believed the present Act had the effect of allowing a very considerable exemption from primary vaccination. The extension as to age enabled parents with their children to travel about from one town to another, with the result that many of these people were lost sight of by the vaccination officer. That was one reason why he thought the Vaccination Acts would be much better administered by a central authority. In visiting districts where small-pox had broken out he had frequently found streets in which a large number of children were unvaccinated. They were for the most part children whose parents had removed from some other district, and they would be much better got at through a regular inspection by the officers of sanitary authorities. He agreed with the very interesting remarks of Dr. Williams; and thought that more definite powers ought to be given to the authorities to deal with persons who had been in contact with small-pox on board ships. If they could have some such power as was given in the case of cholera, plague, or yellow fever, under Article 8 of the Local Government Board Regulations, it would be something. Certainly they ought to have more power in dealing with "contacts" in general. It was no use the Local Government Board simply saying they

would sanction the expenditure of a certain amount of money on the detention of "contacts" either in their homes or in some shelter. These cases ought to be detained under the strict supervision of the sanitary authority. Alluding to the remarks of Dr. Jones as to re-vaccination, Dr. Walford said they very often did not hear of a case of small-pox until the eruption was well out. Although it was right to re-vaccinate all who had been in contact with the case, they knew from experience how very frequently it happened that some of those persons were vaccinated too late to prevent them taking the disease. When such persons were exempt from observation or detention considerable danger existed.

Dr. Fisher (Garstang) said that as medical officers they were agreed that tramps were a nuisance. The great question they had to decide was what they were to do with them. The tramp lived under such conditions that he not only could and did carry about infection, but himself often generated the disease. He had for some time been taking charge of a small-pox hospital, and he was fully convinced that the tramp was one of the most fertile sources of the spreading of the disease. Very definite legislative powers were required to deal with him. It was no easy matter to get him to be vaccinated; at least, that was his experience. In the tramp they had a combination of ignorance and stupidity, and he was not only a nuisance to himself but to the public at large. In speaking of the discharged army-man, of course they all knew that soldiers were re-vaccinated. He should like to say, following a remark made by the President, that it was of the utmost importance never to take the word of a patient. Upon the whole subject of vaccination a very important lesson had been taught us by the Germans. It was a remarkable feature of Germany that it was now practically immune from small-pox, and there was no doubt that vaccination and re-vaccination had a most important bearing on the subject. It was a difficult matter to say what legislative power should be brought to bear upon tramp-life in this country in order to insure immunity from this terrible disease. It was most important that the tramp should be rendered immune, for his present condition was not only a public danger, but the cause of much financial loss. He held the opinion that the immunity produced by re-vaccination of most tramps is not so lasting or effectual as with the ordinary civilian, consequently he advised if small-pox is prevalent that all tramps should be tested by vaccination. Some legal means should be instituted for the effectual control of tramps.

CONGRESS AT BRADFORD.

CONFERENCE OF ENGINEERS AND SURVEYORS TO COUNTY AND OTHER SANITARY AUTHORITIES.

BRADFORD CITY TRAMWAYS AND ELECTRIC TRACTION.

By J. H. COX, M.Inst.C.E.,

City Surveyor, Bradford.

DURING the last few years the subject of Electric Traction has been dealt with most exhaustively by numerous Tramway Engineers, and this short paper is therefore merely intended as a brief general statement of the present position of Electric Traction in Bradford.

The first tramways in Bradford were opened early in 1882, and were mainly worked by steam haulage.

Horse traction was used on one Section, Manningham Lane, which is comparatively level, but as nearly all the main roads leading from the centre of the City are steep, steam haulage became a necessity.

The introduction of electric traction came a few years later at Blackpool, Newry, and near the Giant's Causeway, and it was about 7 years later before Mr. Graff Baker constructed his Electric Tramway at Roundhay Road, Leeds.

In September, 1895, the Kingswood Section of the Bristol Tramways was opened for traffic by the Imperial Tramway Company, and since then rapid progress has been made in electric traction in this country, the length of tramways worked electrically in 1897 being 40 miles, whereas to-day it is over 900 miles.

NOTE.—The proceedings of this Conference commenced with an Address by T. H. YABBICOM, M.Inst.C.E. (*see page* 200).

The Leeds Corporation Tramways came into existence in 1897, and were the first installed by a Municipal Authority.

Bradford followed in 1898, when, after careful consideration of the various systems of tramway in operation, including Cable, Electric Overhead, Underground, and Surface Contact, the Corporation decided to select the Overhead trolley system, which has since been generally adopted throughout the country.

To-day the total route length of tramways worked by the Bradford Corporation is 43 miles, 513 yards, mostly double track, equal to nearly 75 miles of single track.

Of the above route length, 5 miles 1672 yards is outside the city boundary, and of this 1 mile 815 yards belongs to the Shipley District Council.

Shipley Tramways.—Terms of Lease.

The tramway belonging to the Shipley District Council extends from the city boundary at Frizinghall to Moorhead Lane, at Saltaire, and is leased to the Bradford Corporation on the following terms, which were fixed by Arbitration, viz. :—

1.—Lease to be for a period of 30 years.

2.—The Bradford Corporation pay the Shipley Council interest and sinking fund charges at the rate of £5 14s. 6d. per cent. per annum, for 30 years, from May 17th, 1903, on £27,614, the sum expended by them on the construction of the tramway.

3.—The Bradford Corporation pay Shipley Council interest and sinking fund at the rate of £4 10s. 3d. per cent. per annum, on the capital sum of £12,642 expended by them on Street Improvements.

4.—Shipley Council are to supply sufficient electrical energy for the proper working of the tramways at $1\frac{3}{4}$d. per Board of Trade Unit, measured at the Station, but the price chargeable is subject to revision every five years.

5.—The Shipley Council to maintain the tramway track, cables, feeders, and posts; but the overhead equipment is to be maintained by the Corporation.

The Corporation have also to contribute the sum of £100 per annum per mile of double track towards the cost of maintenance, and in consideration of this payment they are to be relieved of all liability in respect of any accident arising from the defective condition of the tramway.

6.—Cost of Arbitration to be borne equally by both parties.

Overhead Equipment.

The overhead equipment is of the usual standard form; centre pole, side bracket, and span wire construction have been used to meet the varying conditions of the several tramway routes.

Flexible suspension fittings have been fixed to all the bracket arms.

Experience has shown that it is not advisable to erect centre poles, except in streets where the carriageway is at least 45 feet in width.

It will be interesting to compare the working of the overhead system with that of the underground conduit system, as adopted by the London County Council, and also with the Lorain surface contact method, as laid on a portion of the Wolverhampton tramways.

At present the advantages as regards cost of construction and working appear to be in favour of the more popular system.

Rails.

The section of girder rail now used in Bradford is supplied by Messrs. Walter Scott & Co., Ltd., Leeds Steel Works, No. 15 in their list.

It is 7 in. deep, with a groove $1\frac{1}{8}$ in. in width, and $1\frac{1}{8}$ in. in depth. The rails are rolled mainly in lengths of 45 ft., and weigh 102 lbs. to the yard.

The chemical constituents of the rail are as follow :—

Carbon	·4 to ·55 per cent.
Silicon	traces.
Sulphur	not more than ·06 per cent.
Phosphorus	average, ·08 per cent.
Manganese...	·7 to 1·10 per cent.

The specification states that the tensile stress must be 40 to 44 tons per square inch, with an elongation of not less than 15 per cent. on a length of 8 inches, and a contraction of sectional area of not less than 30 per cent.

Rail Joints.

The rails are jointed with steel fishplates weighing $73\frac{1}{2}$ lbs. per pair.

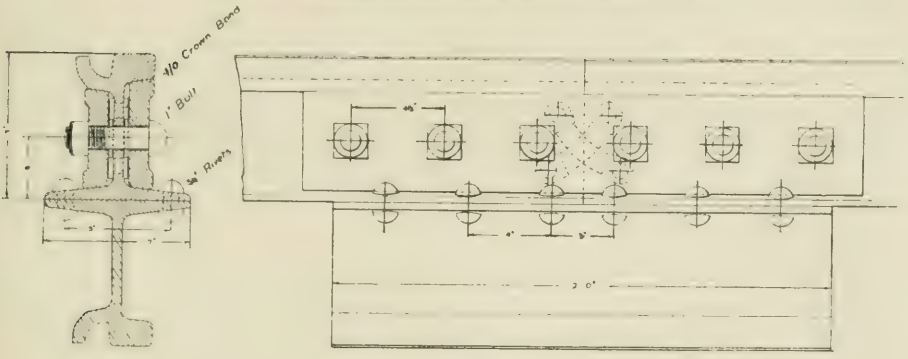
Latterly, Cooper & Howard Smith's Patent Anchor Joints have been largely used in addition to the fishplates. At present these joints appear to be answering satisfactorily, but they have not been in use sufficiently long to enable one to give a definite opinion.

The apparatus has recently been obtained for making joints by Dr. Goldschmidt's Thermit welding process, but unfortunately the author is not in a position at present to give any reliable report on the subject.

At Leeds, where a great many joints have been made during the last six months by this process, they appear to have given satisfaction. Apparently, it has proved more successful than either the Falk welding or the electric welding processes.

BRADFORD CITY TRAMWAYS.

DRAWING OF RAIL JOINT.



Curved Rails—Manganese Steel.

One or two quick radius curves have been constructed with manganese steel rails, cast in 12-ft. lengths by Messrs. Hadfield's Steel Foundry Co., Ltd., of Sheffield. They have only been in use about four months, and up to the present they have justified their adoption.

Points.

The points used on the Bradford lines are 9 feet in length, made of patent manganese steel, with tongues 4 feet 6 inches in length; some are straight and others are made to a radius of 100 feet. The core hollows in points, and crossings are filled with concrete before being laid.

If the Standards Committee, who have recently done such good and useful work in standardising tramway rails, could also give their attention to tramway points it would be of great advantage to tramway engineers.

Bonding.

The electrical bonding of the rails is done with short Chicago Crown T. Bonds, 4 inches centre to centre, fixed under the fishplates, which act as a protection to them.

Special Lay-Outs.

In May, 1902, certain portions of the curves and junctions into Bridge Street, from Tyrrel Street, Market Street, and Leeds Road, were specially made by Messrs. Hadfield's Steel Foundry Co., Ltd., of Sheffield, with their patent manganese steel rails, points, and crossings, and they seem to be answering very well, though up to the present they have not been subjected to any great amount of traffic.

Wear and Life of Rails.

Experience at Sheffield tends to show that the wear of rails is greatest on the down tracks; very probably this is accounted for by the greater use of the brakes, especially the slipper brakes, which the Board of Trade require to be used on the downward journey whenever the gradient is 1 in 15, or steeper.

Experience, in Bradford, shows slightly more wear on the downward tracks, but greater damage is done to the track generally on the upward journey. On the comparatively level portions of tramway the damage to the track is mainly due to the speed at which the electric cars run.

Under the heaviest traffic, in Bradford, it is expected that a life of eight to ten years will be obtained on straight track, and about three years on curves. Under the lightest traffic twelve to fifteen years' life is anticipated on the straight lines, and about five years on curves.

Paving.

In Bradford the tramway tracks are paved with 3-inch by 6-inch granite setts, except in a few streets near the centre of the city, where Australian hardwood blocks have been used.

The granite setts are obtained chiefly from Leicestershire, Wales, Scotland and Norway, the harder setts being reserved for the level roads and the softer setts for the steeper gradients, which in Bradford are very numerous.

Concrete foundations, composed of broken stone and portland cement in the proportion of six to one, are laid for the paving of all tramway tracks.

The wood blocks used for paving tramway tracks are 3″ by 9″ and 5″ deep.

They are laid on a concrete foundation which is floated to a smooth surface so as to admit of the blocks being laid directly on the concrete.

They are first dipped to a depth of three inches in hot pitch and set on

the smooth concrete surface with at least one-eighth of an inch joint between every course, and also endwise between every block. The space between the ends of the blocks laid between the rails is slightly greater than those at the side, but a space of about one inch is also left against the kerb on each side of the road for expansion of the blocks, and filled in with pitch, which will compress when expansion of the wood takes place.

Some difficulty has been experienced by the rising of the blocks adjoining the tram rails which appears to be due to water getting into the spaces formed between the end block and the steel rails.

To avoid this difficulty it is proposed to shape the end wood blocks to fit into the web of the rail, and it is hoped that the adoption of this course will more effectually keep out water and prevent any further lifting of those blocks which adjoin the rail.

Speed.

Several months ago an application was made by the Tramways Committee of the Bradford Corporation to the Board of Trade for sanction to run at greater speeds than previously allowed on the Bradford tramways, in consequence of which Major Pringle inspected all the lines in April last, and recommended that Regulation No. 6, which limited the maximum speed to 9 miles an hour, should be revised and the speed increased to 12 miles.

In narrow roads the speed is limited to 9 miles an hour; on very steep roads 4 to 6 miles; and through facing points, whether fixed or movable, and on quick curves, 4 miles an hour.

There is no doubt that the quicker service and extra speed attained by electric cars cause considerably more wear and damage to the tramway tracks than formerly, but the requirements of the public to-day call for more rapid locomotion than was possible in the days of horse and steam traction.

Electric tramways have now become serious competitors with railways for urban and inter-urban traffic.

The Railway Companies in the West Riding of Yorkshire, as in other populous districts, have been seriously affected by the great increase in electric tramway traffic during the last few years. To all appearances it is likely to increase still more rapidly than ever, and Railway Companies will have to depend more on their long distance traffic for their revenue in future.

(For discussion on this paper see page 679.)

BRADFORD CITY TRAMWAYS.

By C. J. SPENCER, A.M.I.E.E.

Operating Department.

Rolling Stock.—All cars are bought by the Tramways Committee in detail and erected at the Tramway Works, Thornbury, ready for service This means that motors, trucks, car-bodies, trolley standards, etc., are ordered separately and assembled under the management of the Tramways Department.

At present sufficient material has been delivered or is on order for 230 double deck, reversed staircase, 52 passenger single truck cars; equipped with series parallel controllers and two 30-h.p. motors (one geared on to each axle).

In addition to the ordinary hand-brake, the cars are provided with an electric rheostatic brake and mechanical slipper-brake, with double sand-boxes worked from one pedal.

Snow-ploughs have been built in the tramway workshops which have proved very effective in heavy snow-storms.

Electric Power.

Power is supplied to the Tramways Department from the electric power station under the Electricity Committee at the price of 1d. B.O.T. unit delivered at the section box.

The annual unit consumption is about 6,600,000, running out at about 1·6 per car mile on the whole system.

On some sections, the consumption per car mile is as high as 1·9 to 2 units per mile, and on others as low as 1·1 or ·9. This result, of course, is accounted for by the fact that Bradford is geographically in a sort of natural basin, surrounded on all sides by hills, so that the majority of the sections running from the centre of the town are routes of long steep gradients.

A peculiar and interesting fact is sometimes noticeable. A strong wind blowing across the city, say from west to east, will cause the

current consumption to rise on sections running west from the centre, and *vice versâ* with sections running in the opposite direction.

Overhead Equipment.

At the present time there are between 80 and 90 miles of wire on the tramway system. 3/0 pure copper wire is used on all lines, that is, a diameter of ·409 inch. With the bracket arms the well-known flexible, bow-string suspension has been adopted.

Trolley-wire accidents of a serious nature have been unknown in Bradford. Guard wires are used wherever telephone or telegraph wires cross the track, in accordance with the regulations laid down by the Board of Trade.

Numerous instances have occurred in which telephone wires have dropped, but have always been harmlessly suspended by the trolley wire, or they have come in contact with both the trolley wire and guard wire and been burnt clear away.

A regular system of inspection is in vogue so that wire accidents are reduced to a minimum. The whole of the overhead equipment is erected to the instructions of the Tramways Committee, direct labour being employed; the City Engineer being responsible for the erection of the poles and the Tramway Manager for the fixing of the overhead wires and fittings. A petrol motor tower wagon fully equipped with tools and appliances is kept standing by for emergency calls throughout the running hours of the day. A turn-out from receipt of a message that something is wrong, can be made inside fifteen seconds, and as the wagon is of light construction and the horse power of the petrol engine high, the possible speed attainable enables the breakdown gang to reach any part of the tramway system from the centre in a very short time. A second wagon, equipped with a petrol engine of a smaller horse power, is used for inspection and light work, and has effected very considerable economy over horses.

Special instructions have been issued to the police regarding accidents to overhead wires generally, drawn up by the City Electrical Engineer and the Tramways Manager.

The cars are fitted with automatic earthing switches, whereby the current may be cut off at the Power Station from any car, by simply breaking a small pane of glass.

Depots.

The Tramways Committee have adopted the system of a number of Depôts at various parts of the tramways for housing cars, in preference to having them in one large Depôt. This has been done with the object of

saving as far as possible waste mileage in cars travelling from all parts of the system to one point.

The main running shed and repairing works are situated at Thornbury, where 160 cars can be stored at once, if necessary.

From here most of the sections receive additional cars to accelerate the services.

In the works the whole of the repairs in connection with cars, trucks and equipments, are executed by the Corporation workmen. Car bodies are painted and varnished; trucks, motors and controllers thoroughly overhauled and renewed, when necessary in the shops. Wheels and axles renewed and repaired. Armatures and field coils repaired and re-wound.

All repairs of every description to rolling stock are undertaken at this Depôt.

The works have been designed to undertake the ordinary overhauling and repairing of a system of 300 cars.

Compressed air is extensively used for the purpose of car cleaning, wood-boring and the working of portable tools generally, and has been successful as a labour-saving device in the shops.

At the present time five or six cars per week are being put through the shops for overhauling purposes, consequently each car on the system is regularly overhauled and examined at least once in six months. The Corporation believing in the principle that "a stitch in time saves nine."

About 100 employés are engaged in this Depôt in repairing work, composed largely of mechanics, wood workers, painters and electricians, with the usual proportions of labourers.

Traffic Arrangements.

Services, fares and routes have been arranged to meet the requirements of the different districts through which the cars run. On some busy lines a service of cars every 2 or 3 minutes is run, whilst on the quiet lines a service with a frequency as slow as 20 minutes has been found sufficient.

The average distance run for a 1d. is about 2 miles, and the maximum fare inside the city 2d. This means that in some cases a distance of between 4 and 5 miles can be ridden at ordinary fare, 2d. Before 8 a.m. a universal 1d. fare has been adopted on the whole tramway system, that is to say, from the centre to the outside, or *vice versâ*, the fare is 1d. any distance.

In order to have good time-keeping, an automatic electrical time-recorder has been devised by the writer, by which means the time each car leaves any terminus, or passes any given point, is automatically recorded.

A contact arrangement is fixed near the trolly wire, so that when the car trolley passes this point, the electrical circuit is completed through a magnetic device fixed to an ordinary time clock contained in an iron case, and fastened to the ordinary trolley wire pole in the street.

Double track has been laid on the majority of the main lines. On several of the older lines, however, single lines with passing places are in operation, but in all cases where possible, passing-places have been so arranged that drivers of cars can see from one loop to the next, and in cases where this has not been possible, a system of automatic electrical signalling has been devised and erected.

In this system electrically operated semaphore signals are worked from the trolley circuit, the circuit being closed by means of a specially designed contact arrangement, which is operated with the trolley. The adoption of this principle has been found very effective in preventing the annoying delays consequent on working single line with passing-places.

Organisation.

The total staff on the tramways operating department, which is subordinate to the Tramways General Manager, numbers about 950 men.

The operating department is subdivided into the Technical, Traffic, and Clerical departments, each being controlled by a Superintendent.

Drivers and Conductors are divided into three classes, first, second and and third; the pay being *pro rata* with the class.

Length of service and conduct determines promotion from one class to another.

A system of bonuses has been adopted for Drivers and Conductors who have been free from accidents and irregularities for three months. The result of this system has been very gratifying to the Tramways Committee.

(*This discussion applies also to the paper by* Mr. J. H. Cox.)

Alderman Adcock (Dover) asked whether he could get some information with regard to the wear and life of the tramway rail. He had no doubt that in a great many towns, corporations, anxious to make tramway undertakings as successful as possible, had not paid due regard to the short life of the rails, nor had they set aside a sufficient sum to renew these rails at the expiration of ten or twelve years. His own Corporation had acted in a very foolish manner, and perhaps they did not stand alone. The Dover tramways had been running for five years, and the corporation had not, up to the present time, set aside a single penny to renew rails, but had been satisfied to keep the cars and rails in repair.

He had pressed on them the desirability of establishing a reconstruction fund, so that at the end of ten years, when the rails were worn out, there would be some money to replace them; and, on his motion, the suggestion was referred to the Town Clerk and Surveyor, by whom it was at the present time being considered. If he could get some information from Bradford and other towns running electric tramways as to the percentage they put aside for depreciation, it would be exceedingly useful to Dover. It was estimated at Dover that in ten years they would have to renew the rails at a cost of about £4,000 per mile. Up to the present time they had been setting aside profit from their tramway running to the amount of 5 per cent. on the capital expenditure to the relief of rates. He contended that that 5 per cent. ought nearly all to have been set aside to a depreciation fund to renew the rails when they were worn out. He thought it would certainly be of profit to find out what was being done in other cities.

Mr. James Lemon (Southampton) said that in reference to the mode of laying wood blocks, touched upon in Mr. Cox's paper, he thought the method adopted in Bradford accounted for the blocks rising under certain conditions. He thought the eighth of an inch joint, specified in the paper, was not sufficient, and should prefer to see the wood blocks laid close sideways, and greater space left between the ends. Then again, the one inch left against the curb on each side of the road, allowed for expansion of the blocks, was not sufficient. In his own town they greatly exceeded that, with the result that there had never been any difficulty through the rising of the blocks under any conditions. He did not think proper attention was paid to the draining of the surface of the concrete upon which the blocks were laid. The water was left to soak away as best it could. When one considered that the concrete was well floated with cement, and in great measure was an impervious surface, special means ought to be taken to drain the water which found its way between the blocks into gullies. If more attention were paid to this there would not be the complaints that were occasionally heard of wood blocks rising and causing inconvenience. He could quite endorse the remarks of the last speaker, that local authorities did not set aside sufficient for depreciation. They seemed quite to overlook the comparatively short life of a tramway rail. But, of course, if the information for which Alderman Adcock had very properly asked were given, it would have to be taken with due regard to the particular traffic on the rail, because in a large town like Bradford the rail would have a much shorter life (due to the heavy traffic) than it would have in Dover. If the information asked for were given it would, of course, form a basis on which depreciation might be estimated in other towns.

Mr. Arthur Smith (Dartmouth) said there was much in the two papers that was of use to those representing other towns at that Conference. All surveyors and engineers, or nearly all of them, would in the near future have to contend with this greatly increasing and very desirable traffic, and the

more facts, and the more experience they could gain, the better it would be for them. He for one would like to accept the invitation of the reader of the paper to see the jointing machine of Dr. Goldschmidt. He quite agreed with Mr. Lemon that very frequently there was not, in the laying of wood paving, that attention given to underdrainage that there should be. Some three years ago he cured a piece of wood paving that had risen. It had been laid by a contractor previous to his going to the district, and one thought at one time it would all have to come up and wider end-joints would be given. Such paving was often put on a good bed of concrete, and very often a tank was formed underneath. In this instance blocks were taken up in sections and drainage made lengthwise and across, and the water was allowed to drain away into the side gullies. That saved the pulling up of a considerable portion of wood block paving. If in the laying of concrete under wood-paved roads proper provision was made here and there for draining (the drainage channels being properly protected so that no trenches should be shown in the wood paving) the difficulty of the paving rising after a heavy rainfall would be avoided.

The President (T. H. Yabbicom) said he could not help thinking that the Shipley District Council had no reason to be dissatisfied with the terms they had made. There was one point in connection with the award which he could not quite understand, reading it in connection with a statement made in Mr. Spencer's paper. Mr. Cox said that the Shipley District Council were to supply sufficient electrical energy for the proper working of the tramways at $1\frac{3}{4}$d. per Board of Trade unit. Mr. Spencer said that power was supplied to the Tramways Department from the electric power station under the Electricity Committee at the price of 1d. per Board of Trade unit. There was a good margin between these two. Either the Shipley Council were getting a very good profit, or the Electricity Committee of the Corporation might find that their accounts did not exactly balance at the end of the year. He was quite of the opinion that it was not desirable to erect centre poles except in carriageways which were not less than 45 feet wide. If centre poles were put up in streets where there was not room for double lines of traffic on each side of the tramway, they were a great inconvenience. He should also like to emphasise the importance of under-drainage in wood blocking. Unless there were sufficient under-drainage the rain, especially when the work was new, would get through the joints and form a little lake below, lifting the wood blocks completely. He noted that at the Bradford repairing works compressed air was extensively used for wood-boring and working portable tools. He did not know whether it had entered the minds of the Bradford officials that small electric motors were very useful for such a purpose, and, electric power being available, would be very economical.

Mr. Dawson (Deputy Surveyor of Bradford) replied to the questions raised. Depreciation in tramways was of great importance, because it meant all the

difference as to whether a tramway paid or did not pay. Considerable sums of money might be received from tramways, but if a sufficient sum was not set aside to allow for depreciation, any municipality who worked tramways would in a few years be in the same position as Dover. In Bradford, for instance, the first tramways were laid in 1882, and leased to a Company for a period of twenty-one years at £290 per mile per annum, which represented about $6\frac{3}{5}$ per cent. on the capital expenditure. The money was borrowed for a period of thirty years, the term granted by the Local Government Board, but the tramway had to be relaid at the end of fourteen years, so they not only exhausted their capital expenditure on rails in fourteen years, but had to lay new lines for the benefit of the Company, and in order to eke out the lease. When the tramways were first laid in Bradford no one knew whether they would pay or not, and there was very little competition when the Corporation wished to lease them as they were at that time bound to do. Steam traction was then used. Now we are working our tramways by electric traction, and some people were of opinion that electric traction would wear the lines much less than steam traction. He did not think so; at least he did not think it would be the experience in Bradford by any means. On examining these tramways he saw indications of considerable wear and tear already. The question had been asked, "What sum should be set apart for depreciation"? Mr. Cox stated in his paper that he estimated the life of rails on a straight track in Bradford to be eight years. If that were so he thought there should be set apart every year a sum which would at the end of eight years pay off the interest and sinking fund on the portion of the tramway which would have to be renewed at the end of that time. If the Dover tramways were depreciated on these lines, he thought it would be found that instead of setting apart a sum for the relief of the rates the Corporation would have to ask the ratepayers for a rate in aid (Alderman Adcock: "I quite agree"). This was undoubtedly a question of great importance to municipal authorities, all the more important because in all Councils there were two parties, one contending that every municipal enterprise should pay, whatever its character, and the other holding a contrary opinion. Therefore, the happy mean had to be hit upon, and it was the duty of the officials to arbitrate in a perfectly impartial manner between the two sections. At the present time in Bradford a discussion is taking place as to what sum should be set apart for depreciation. He thought the Corporation should set apart such a sum as would renew their tramways when they were worn out, irrespective of the period for which the money was borrowed.

A delegate asked whether in Bradford a sum was set apart for the renewal of cars?

Mr. Dawson said a sum was set apart, but he could not say exactly its amount. With reference to the remarks about wood paving, he thought perhaps

it would be out of place for him to say anything on the subject after what had been said by Mr. Lemon, but it seemed to him that the suggestion as to underdrainage was one that should be followed out. Something of the kind had been done in Bradford, but perhaps not so extensively as Mr. Smith and Mr. Lemon advocated. However, their remarks were well worthy of consideration. With regard to the President's observations about the arbitration which took place in reference to the terms upon which a tramway should be leased from the Shipley Urban District Council, he might tell those gentlemen who were not conversant with this district, that Shipley was an urban district adjoining Bradford. For a great many purposes it was part and parcel of Bradford. The Shipley tramway was a continuation of the Bradford tramway. It was quite evident it would be to the mutual advantage of Shipley and Bradford that this tramway should be leased to Bradford, and worked by the City Corporation. Bradford was applying to Parliament for powers to construct certain tramways, and the Shipley Council got a clause inserted in the Act compelling the City to lease the line on terms to be settled by arbitration, if satisfactory arrangements could not be made otherwise. He thought with the President that Shipley certainly had the best of the bargain. But although Bradford is a large place, their smaller neighbours did sometimes get the best of the bargain. There was one other matter he would like to make clear, namely, the difference in the Shipley and Bradford charges of electricity used for tramway traction. The Shipley tramway was supplied with electricity from the Shipley electricity station, and it was a condition of the Board of Trade Arbitrator that Bradford must pay for the electricity $1\frac{3}{4}$d. per unit. There again Shipley had the better of the City. The Tramways Committee of the Bradford Corporation paid to the Electricity Committee, who generated the current, a penny per Board of Trade unit for the electric energy used on the other tramways, but Mr. Chattock, the City Electrical Engineer, is of the opinion that it does not pay by one-eighth of a penny per unit. If he could get $1\frac{1}{8}$d. per Board of Trade unit it would pay the Electricity Committee; so assuming that this was the paying figure, the Shipley District had the better of the City to the extent of the difference between $1\frac{1}{8}$d. and $1\frac{3}{4}$d. per Board of Trade unit. Mr. Dawson said that electric power was used at the tramway depôt as well as compressed air for working small tools and drills. Electric power had been used for laying the tramlines, and electric drills had been used to drill bolt-holes, etc.

THE FIRE ALARM TELEGRAPH SYSTEM INSTALLED AT THE CENTRAL FIRE STATION OF THE BRADFORD CORPORATION.

By R. A. CHATTOCK, M.I.E.E.,

City Electrical Engineer, Bradford.

IN the following paper it is proposed to describe in detail the system of fire alarm telegraphs that has been installed by the Fire Brigade Committee of the Bradford Corporation.

The system consists of a number of fire alarm signal boxes placed in convenient positions in the city. These boxes are connected by underground cables with the central fire station. Each box is numbered, and all that has to be done in order to give an alarm is to turn a handle projecting from the box. This operation sets a clock-work mechanism inside the box in motion, and a series of signals is transmitted to the central station. These signals correspond with the number of the box operated, and by means of an ingenious instrument at the central station, the number of the box operated is shown on an indicator and is also heard on a large gong, the number of the box being represented by the number of beats on the gong. Thus, for box 32 there would be three beats, a pause, and then two beats on the gong. The number of the box operated is also permanently recorded at the central station on a tape machine and on a perforating register. On this the year, month, day, hour, and minute of the receipt of the signal is also legibly stamped.

From the central station sub-circuits run out to the various district fire stations situated in the outlying parts of the city. The receipt of a signal at the central fire station is automatically handed on to these district fire stations, and the number of the box operated is indicated to them on an indicator and a gong.

The operation of the system is as follows:—An electric current of

one-tenth of an ampere is caused to flow continuously through each circuit, the energy for this being derived from one of two sets of accumulator cells installed at the central station. The current on its way through the circuit passes through each of the signal boxes. Any interference with the circuit which causes a stoppage of the current, whether by accident or design, is immediately recorded by instruments at the central station.

The mechanism in each signal box is so arranged that a certain number of stoppages of the current are made corresponding with the number of the box, and in this way the instruments at the central station are made to record the correct number. If through any accident the circuit be broken and the current is stopped, an immediate notification is given at the central station by a single blow on the gong; in this way the apparatus safeguards itself by instantly giving notice when any conditions arise through which it might become inoperative.

The great advantage of a "closed" circuit system such as this over an "open" circuit system lies in the fact that the latter has to be closed and an electric current caused to flow before a signal can be transmitted. It is much easier to interrupt a current that is already flowing than to cause one to flow round a circuit. The latter operation depends on numerous electrical contacts being clean and in good order, on the absence of breakages in the line, on the condition of the electric battery, and on the receiving instruments being in thorough working order.

These various points may be tested several times a day, yet at the critical moment when they are most required to be in proper working order it is impossible to be absolutely sure that they are going to act satisfactorily.

With the "closed" circuit system, the very fact that the current is always flowing guarantees that all the above points are in proper working order, and by this means a most important safeguard is effected.

The signal boxes on the circuit are of the non-interference type, this means that if two or more boxes located on the same circuit are operated at the same time the signals will not interfere one with another, but the box that is operated first, if it be by only a fraction of a second, will send in its signal, and when this has been completed the second box will then send in its signal.

Should two alarms be sent through from signal boxes on different circuits they are dealt with by an instrument at the central station called an Automatic Repeater. This instrument will only receive the signal from one box at a time, and it automatically hands this on to the indicating arrangements and also to the sub-circuits connected to the

district fire stations. As soon as the first signal has been completed it will deal with a second one coming from a box on any other circuit.

It is this instrument that gives an indication of a fault on the circuit, and should such a fault occur it throws the disabled circuit out of service and leaves all the others in operation. When the faulty circuit has been repaired this instrument automatically takes it into service once more.

Each fire alarm signal box on the circuit is fitted with a connection for a portable telephone. This can be inserted and conversation with the central station carried on without rendering the circuit inoperative for the receipt of an alarm. In this way when the fire brigade has reached a fire it can ring up the central station and ask for further assistance if necessary.

The central fire station is situated in Nelson Street and from this point the circuits start, each circuit following a main road from the centre of the city.

The maximum number of signal boxes on any circuit at the present time is eleven. The total number of boxes installed in the city being seventy-seven. Each circuit is capable of carrying twenty-five boxes, so that the total capacity of the whole system when completed will be 250 boxes. Provision is thus made for extending the system by running branch circuits off the main roads to any point where it is considered desirable to place a signal box.

The circuits themselves consist of twin insulated cables armoured with steel tape and laid direct in the earth. The opportunity was taken to lay these cables at the same time that the electric feeder cables were laid for supplying the Corporation Tramways, and the expense of opening up the ground specially for this purpose was thus considerably reduced.

The sectional area of the copper wire used in these circuits is ·005 square inches. Each circuit forms a complete loop of copper wire with the various signal boxes inserted in it, in series one with another. The total length of underground cables laid for this purpose is 42¼ miles, and the cost of carrying out this part of the work has amounted to £10,162.

The work itself was carried out by the Electricity Department of the Bradford Corporation, and the fixing and connecting up of the signal boxes was also carried out by them.

At the central fire station is the main switch room to which all the circuits are taken. Here are installed the various switchboards and instruments described above for controlling the whole of the system. The apparatus installed here is an excellent example of the perfection to which switchgear and instrument work can be brought.

With this system of fire alarms it is possible to run auxiliary circuits in private buildings connected to any street signal-box. By adopting this method instantaneous communication with the central fire station is available in any building so fitted up, and the time taken in getting to a street alarm box is obviated.

The system has now been at work for 12 months and is found to be considerably quicker in operation than sending an alarm by public telephone. Fifty-nine calls have been received and there has been no hitch of any kind in operating. The only disadvantage appears to be the receipt of false alarms. The signal boxes are so very easily operated that mischievous persons have been tempted to work them. In order to guard against this each box is fitted with a loud-sounding bell, which is put in motion and rung for a considerable time as soon as the handle is turned. In this way it is impossible to manipulate the box without calling the attention of passers-by in the neighbourhood. The only remedy for such misuse of the system is to summon the delinquent and inflict a substantial fine for malicious interference.

In conclusion, the author hopes that the short description he has given of this most interesting and well-thought-out system of fire alarms may be of interest as affecting the welfare of a large city.

The apparatus can be seen at work by those desirous of so doing at the Central Fire Station, Nelson Street; and even a cursory examination will show how very carefully it has been designed, and how entirely automatic it is in every detail.

CEMENT JOINTS IN DRAINS AND DRAIN-TESTING.

By JAMES G. D. ARMSTRONG,

Prof. Assoc. Surveyors' Institution.

(MEMBER.)

IT has been patent to me for many years that cement joints in stoneware drain pipes fail to maintain their power of standing, both, or either, the smoke and hydraulic tests, and this, sometimes, soon after the laying of the drains, and sometimes after a considerable lapse of time. As a rule, however, I find the failures can be traced to either the materials being at fault or the method of laying.

I have often found the flanges of pipes cracked after the water test has been applied, and even before filling in the trenches, and at other times months afterwards when the pipes were bared for connections.

These failures—notwithstanding the drains have been tested by water and found watertight at time of construction—are due to one or other of the following causes :—

1. Swelling of the cement in the joint.

2. Uneven expansion of the concrete bed, especially if made of "hot" cement or ground or lias lime, and not of equal thickness, as when deep holes are filled up in the bottom of trench or in large "hand-holes," the expansion lifts the pipes off their bed.

3. Uneven settlement of the bed, causing deflection of the adjoining joints.

4. Uneven or careless filling-in of the trench, or workmen walking on or knocking the pipes, or by debris falling, etc.

5. Testing or filling in the trenches before the cement is thoroughly hard.

6. Contraction of the cement in the joints.

7. Failure of the joint to stand the pressure, excepting of course the jointing material.

Causes 1, 3, and 6, are due entirely to the quality of the materials at the time of using or to their wrong manipulation. A thoroughly practical and theoretical knowledge of Portland Cement is absolutely necessary that no failure may arise from this material. In this short note a complete specification of this material cannot be given, but suffice it to say it should be tested for Contraction, Expansion, Adhesion, Disintegration (by boiling for 24 hours after pats have been made for 24 hours), Specific gravity, which should be about 3·1 (weight per bushel is an unreliable guide) also whether it contains free lime or free gypsum; then further for tensile strain which should be not less than 500 lbs. per square inch at 7 days, the briquettes being mixed up as stiff as possible and "thumbed" into the molds; and lastly, but perhaps the most important, its fineness, 80 per cent. should pass through a sieve having 32,400 (thirty-two thousand four hundred) holes per square inch, and the whole through a sieve of 2,500 (two thousand five hundred) holes per square inch. If not very finely ground it may expand months after using, thereby cracking the flanges *or loosening the key between the pipe and the cement.*

Cause 2.—I do not agree with the use of hot lime for foundations owing to its expansion; so far as lime is concerned it should rank in the same catagory as clay joints. Cement only should be used.

Cause 4.—As to this, probably more failures in drains found by re-testing arise from these faults than any other, and carefulness alone is the remedy. The same applies to Clause 5, both respecting filling and testing.

Have any persons in this audience or any other person ever heard of a Local Authority *that has power*, and that insists upon testing private builders' cement used for drains; or is there one authority that insists upon testing the drainage of a building by water after everything is completed, and *all external forces and weights have found their permanent bearing?* I know none, not even one, nor any statutory power.

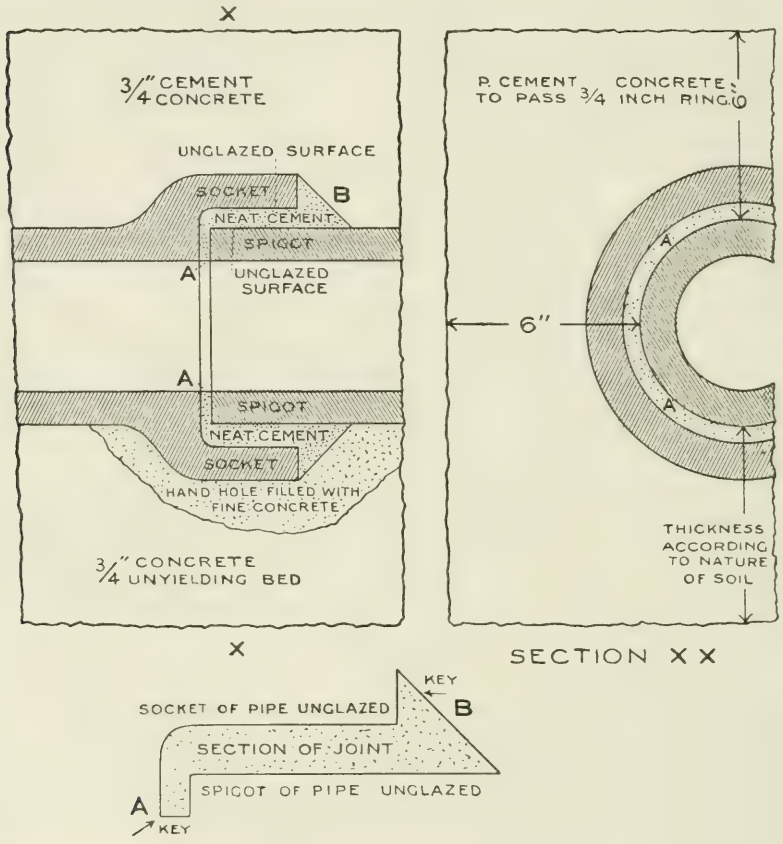
Cause 7, applies in many cases—

(*a*) From improper form of joint.

(*b*) From the sockets and spigots of the pipes being so highly glazed as not to form a proper surface to allow the cement and pipe to thoroughly adhere to make a *permanent* water-tight joint.

Cement Joints for Drain and Drain Testing.

Joint for Stoneware Drains 4" and 6". To stand Water Test to 15 ft. head.



Note.—Spigot and socket unglazed: joint keyed both ends.
Neat cement mixed very stiff, not more than 20% by weight of water.
Unyielding bed of fine concrete, $\frac{3}{4}$" ring round pipes.
Hand holes filled with fine concrete.
No gaskin must be used; joints made 36 hours before testing.
Concrete covering left 12 hours to set before filling in trench.

The only *cement* joint I know that will satisfactorily stand the water test is the one illustrated, the cement should be keyed at both ends, as at A and B, the whole space in the joint being filled in with cement without gaskin or other material, and my personal experience also proves that no sand should be used. The most important point at which the joint should be perfect is at A, between the *end* of the spigot and the *bottom* of the socket, a fact which is overlooked by many engineers who use or specify gaskin, etc.

When the pipes are being glazed in the kilns they are stacked on end, one on top of another, and where the socket and spigot touch the surfaces are unglazed, forming a natural key for the cement. If from careless stacking the ends are glazed, they should be chipped.

Joints made with gaskin should be strongly opposed in all pipes 6" diameter and under: (1) because the most important part of the joint is occupied by the gaskin; (2) because they allow of a large amount of play in the line of pipes, so that the pipes can sag, thus breaking the cohesion between the glaze and the joint; (3) because they allow of inferior workmen making the joints; (4) because they will not stand any pressure, especially if subject to vibration.

Joints made with cement should be absolutely rigid, and drains with cement joints should be laid on a foundation which has *no possibility of uneven settlement if it is intended that they should remain watertight.* If concrete be used, it should be very fine, no part to exceed a $\frac{3}{4}$-in. ring gauged about 6 to 1 of Portland cement (or stronger, according to soil), and should contain sufficient sand to cause it to consolidate in a *solid mass* around the pipes—in fact, to form a concrete pipe, outside the stoneware pipe.

When recently removing some old drains where gaskin had been used and then the joints "collared" with cement, I found the collars in some places loose, and in others a little pressure enabled me to withdraw the spigots from the sockets. I have also found the same result where the part of the joint between the end of the spigot and the socket has not been full but no gaskin used. It is not to be wondered at when the *only cohesion is between the glaze and the cement.*

When the cement used has been of the proper quality, I have no hesitation in saying that very many of the failures found upon retesting arise from the breaking of the seal or cohesion between this glazed surface and the cement, and this may arise from many causes tending to alter the position of the pipes after *first* making the joint, either before the cement is permanently hard or at any future time, or from the contraction of the

cement. It is most imperative that no cement be used for drains which shows any signs of contraction, and that as little water as possible be used in its manipulation. This point is proved by careful observation, which shows that the water oozes out between the cement and the pipe.

Some authorities assert that expansion and contraction in the length of drain causes failure, but I have no personal knowledge of such a result, and cannot in any way conceive how the temperature in a sewer can so affect stoneware and cement. Perhaps this idea has been conceived along with the invention of elastic joints, such as mastic, but I cannot accept the theory without proof, which at present I cannot find.

To avoid several of these failures many patent joints have been produced, the chief principle in which is having some jointing material of an elastic nature, such as pitch compositions. Some are very satisfactory if used in connection with cement. There is no gainsaying that they are but avoidances, not remedies. Cement-jointed drains are now too well established to be altered for general use, and we have to try and make them perfect without resort to patent joints or patent pipes. How can this be done?

1. By having a perfectly rigid foundation or bed. The only way to obtain this is by levelling up on rock with suitable cement concrete, or in other soils by a *sufficiently thick bed of Portland cement concrete*, which should be thoroughly hard and set before laying the pipes.

2. By carefully testing the cement to find its qualities, and selecting suitable material.

3. By instructing workmen, and employing only those who can be relied upon to properly manipulate the materials, and who thoroughly understand the causes which produce failure, not only at first testing, but at future tests in years to come.

4. By *pipe manufacturers* sending out pipes whose spigots and sockets are not glazed; this can be very materially affected by proper stacking in the "salt kiln."

5. By engineers, architects, and local authorities clearly specifying, in detail, not only what has to be done, but by pointing out what has to be avoided.

In these days, when many householders demand a Sanitary Certificate, and rightly so, when the private engineer follows the municipal surveyor, or the doctor or medical officer of health follows one or both, and then the amateur householder follows all with an "asafœtida ferret," and when one or all find fault, surely it is time to pay more attention to materials and to their manipulation than has hitherto been done.

These failures to stand the test have brought about many patent joints, as already said, and are likely to bring more, for we are living in a rapid age, striving for and snatching at every straw to gain advantages: but my argument is, that if the pipes and other materials are of proper quality, and especially that if the concrete is properly made and the pipes encased in a solid block, we, as practical men, have nothing to fear by using ordinary cement-jointed pipes in ordinary works, always bearing in mind that the concrete case must be strong enough to stand any strains put upon it.

Mr. Field (Eastbourne) said he was sure they would all agree that this was a paper of general interest, and he supposed they all had had practical experience in drain testing and could offer practical suggestions. The question as to foundation was of course a most important one, and they must all be of the opinion that unless drains were going to be laid on solid rock or equally good foundation, a good concrete foundation must be provided for them. With regard to the failure of cement joints, and the difficulty of preventing it, the writer of the paper did not suggest what had been done in his (the speaker's) town for some years, and that was to test the drains twice. They were always tested in Eastbourne before being covered up, and again, finally, before the building was occupied, and a certificate had to be obtained before any domestic building could be occupied. Of course that certificate was refused unless the building came up to the required standard. If other towns had not the power to do this he imagined they could get it by an Act of Parliament. That seemed to him to be the easiest way out of the difficulty; the granting of a certificate by the local authority before the building was allowed to be occupied. One of the terms on which the certificate was granted at Eastbourne was that the drains should stand the water test. There were some observations in the paper with regard to lime concrete. He imagined that none of them would attempt to make concrete with whole lime, but ground lime might be used. The remedy one would suggest, if it were possible, was the use of iron drain pipes with lead joints instead of stoneware pipes. If there were any concrete in the foundation, iron pipes would not so easily be broken.

Mr. Arthur Smith (Dartmouth) said there were many things laid down in the paper as not having to be done which he thought were not done by any surveyor present. He did not think that any of those present, in whose duties came the testing of drains and laying of sewers, would think for one moment of using hot lime for concrete foundations or for joints. He agreed that the remedy as mentioned by the previous speaker was to test the drains twice. Double

testing was done in a great many towns, sometimes both by smoke and water, first when the pipes were laid, but uncovered, and again when they had been covered up. The causes Mr. Armstrong had mentioned for the joints giving out were all fairly correct, but he believed that what nearly always gave rise to the failure of the drain at the second test was either "uneven or careless filling in of the trench, or workmen walking on, or knocking, the pipes, or by falling debris, etc," or "testing or filling in the trenches before the cement is thoroughly hard." He did not think Mr. Armstrong's description of an inspector's testing of a drain was correct; if inspectors did not make a far different test than that described in the paper they would be incapable of holding their position. It would, he thought, be a good plan if building inspectors and surveyors, or their representatives, could more constantly supervise the covering of the drains after they had been tested. It was often left to labourers to walk about on them, with the result that they were disarranged, and perhaps would not stand a test immediately afterwards. This was where extreme care was necessary, and he had made it a practice for some time, in the laying of drains and sewers to leave someone on the work until the pipes were filled in and covered by at least 15 or 18 inches of soil.

Mr. Martin (Eastbourne) said that, in his business as a builder, he had a great deal to do with the laying of drains, and he found the great evil was that men were not selected for the work. It was said that anyone could lay drains. A little cement was placed outside around the joint, and the precaution was not taken to fill it up properly. He would not use lime in any state, ground or hot. In Eastbourne there were two tests in force after the filling in of the drain. He believed in cast iron drains because he could depend upon them, after eight or ten years, to stand the water test. The Corporation of Eastbourne granted a sanitary certificate in addition to the one granted by the Surveyor, and landlords were often called upon by incoming tenants to have their drains tested.

Mr. W. Kaye-Parry (Dublin) said he had had a very great deal of experience in the water-testing of drains. He first saw the water test made in Scotland in 1883, exactly twenty years ago. He believed Edinburgh was the first place where the water test was regularly applied. Since 1883 he had applied the test to all the house drains and public sewers he had professionally been engaged in laying. At first he experienced trouble, because the drains were injured in the covering in; but he did not think this was the principal trouble. He now adopted the practice of twice testing all his drains. When the contractors had finished their work he re-applied the water test and saw that the drains would hold water an hour or two and not lose a drop. Nevertheless year after year, going back to the same houses he found, on re-applying the test, that the drains were leaking. He had made experiments himself, and encouraged contractors to make them, and their experience in Ireland was that leakages

were mostly due to the cement used. They found the sockets split across the top owing to the expansion which Mr. Armstrong mentioned in his paper, and which took place sometimes months after the joints had been made. It did not occur immediately, and not even before the second test, and that was where the real danger came in. Those who had to go back and examine their work year after year found that, in a certain number of cases, where apparently the cement had been used too hot or not finely enough ground, the joints had failed, and the pipes had had to be taken up and relaid. So much trouble had arisen with him personally, that he had given up the use of Portland cement altogether. He had found a good brand of Medina cement, which he used for pipe joints. Since then he had had no trouble, and had been able to go back to drains that had been laid ten years and find them (unless they had been disturbed or there was some other explanation) still as watertight as on the day they were put in. Some engineers disapproved of the use of Medina cement, but if a good brand was secured it certainly had this to recommend it, that there was no after expansion; and he had seen hundreds of split sockets where the joints were made of hot Portland cement. There was a good deal to be said on both sides, he thought, with regard to the use of gaskin. There was much to be said in its favour, providing too much was not used, because the inside of the pipe was protected. He had found that with a small ring of gaskin and a good joint of Medina cement, he could make a drain that would remain watertight, and he looked back to twelve or fourteen years' experience in the use of these jointing materials. In reply to a question Mr. Parry said he did not surround his pipes with concrete, but he put them on a bed of concrete and benched them up with it. He had never found that surrounding a pipe with concrete would make it watertight if the joint was a bad one.

MR. LEMON (Southampton) said he thought the writer of the paper had told them all the evils that necessarily arose from badly laid drains. But according to his experience the mistakes he had pointed out were those which every properly qualified surveyor would not make. He agreed with one of the previous speakers, and hoped they would come to a more general use of iron pipes for house drains. He believed that was the only permanent remedy, no matter what people said for patent pipes and methods of jointing. When the cost came to be compared it was not so very material, considering how cheaply iron pipes could be bought. He some time ago drained a large public building entirely with iron pipes. A bed of concrete was laid entirely under the building, the pipes were laid upon saddles, and space was left so that access could be obtained to every joint in the building. He had crawled in to examine the drains and had found everything as sweet and wholesome as could be wished. He would like to mention his experience in reference to gaskin. He drained the town of Lymington in Hampshire, and specified gaskin and cement joints, but he had a particular kind of joint. The source of failure in gaskin joints was, in his

opinion, the use of the ordinary socket of about $2\frac{1}{4}$ or $2\frac{1}{2}$ inches in which a lot of gaskin was put, leaving no room for the cement joint. Therefore he specified that the socket should be $3\frac{1}{2}$ inches deep, and the result was that the job was very satisfactory indeed. He must say, however, that he did not drain any other town on the same principle, because he found the trouble of getting these special pipes made was such, that it was better to resort to the ordinary methods. Mr. Armstrong, he observed, thought the tensile strength of cement should be 500 lbs per square inch. This was an enormous strain which he did not think the drain of any house would be subjected to. However, it was an error on the right side. Mr. Armstrong told a very doleful tale as to the inspecting of drains, but what was the inspector doing to scamp his work like that? He could not understand it. It was his duty to see the drains properly tested, and certainly not to run away and leave the ordinary labourer to fill them in as he thought fit. There ought to be a certain amount of supervision, so that the work should to an extent be completed before the inspector left it. The writer of the paper had made reference to the importance of pipe manufacturers sending out pipes the spigots and sockets of which were not glazed. No doubt one of the failures of the cement joint was that the sockets were glazed and the cement consequently would not adhere; but he thought the engineer ought to exercise supervision and see that he got a pipe on which he could make a proper joint. Mr. Armstrong had performed a useful service in calling attention to this matter, but the only permanent remedy for the failures of house drains was an iron pipe.

The President (Mr. T. H. Yabbicom) said he believed that very frequently a movement in the upper crust of the earth's surface was responsible for the breaking of the joints of pipes. He had great pleasure in thanking Mr. Armstrong for his paper.

Mr. Armstrong (Sheffield) said he did not quite agree with all the remarks that had been made. He had had a pretty large experience in testing drains nearly all over England, and he must say that he had had no experience of gaskin joints proving watertight after they had been laid some time, nor had any speaker given his experience of *re-testing* under such circumstances. The chief cause of failure, he believed, was leverage action on the joint. The cement was only half way through, and the end of the pipe between the socket and the spigot was open, and a small amount of pressure on the surface of the pipe caused a slight amount of sag. If that pipe gave the 100th part of an inch the socket would leak. If the joint were full of cement and nothing else the cement had to be crushed in the joint before it could give. His next point was, that if earthenware pipes were to be laid, they should form practically an inside lining to a solid block of very fine concrete. He had been rather taken to task respecting his remarks on the inspection of drains. The point he wanted to emphasise was this, that when the inspector went round to test the drains and approved them,

he did not stop there till all the work was done which might occasion damage to them, nor were they re-tested after the trench was filled in; that was the difficulty. He, himself, always insisted upon the drains being left full of water till the trench was filled up. As to ground lime he did not think he was wrong in saying, that in all the towns of the north of England ground lime was permissible by the bye-laws, and was used not only by private persons, but by corporations themselves. He had tested many drains which had been laid in lime concrete, and three or four months afterwards he had almost invariably found the joints giving, and it was entirely owing to the swelling action of the lime lifting the pipes off their bed. The leakage was *invariably found to be between the glaze on the pipe and the cement*, the collars were not broken. He thought the whole question would be solved if they could get a sanitary iron pipe. But still, when they remembered the thousands of houses that were erected as speculative property, it was a very large order to say nothing but iron pipes should be used. He had never before heard of such good results from Medina cement, and he was rather surprised to hear it, especially considering that the pipes were not covered with cement concrete.

A DEFENCE OF THE DISCONNECTING TRAP.

By WILLIAM RANSOM,

Assistant Surveyor to Corporation of Worcester.

(Member.)

ABSTRACT.

THE model Bye-Laws issued by the Local Government Board in 1877 contained a clause which really gave legal birth to the disconnecting trap. During the last quarter of a century this trap has been upon its trial, and it is the purpose of this short paper to demonstrate that the trap has more than fulfilled the object for which it was designed. There was a time when in the popular mind sanitation simply meant the insertion of traps here, there, and everywhere. In recent years a reaction has set in, and now we find responsible men even advocating the entire abolition of the disconnecting trap. The reason for this change of front is apparent when the question of sewer ventilation is discussed, for it is sought to ventilate the sewers through the house drains.

In defending the disconnecting trap we must firstly ascertain the necessity of disconnection, and secondly, whether the traps in use adequately fulfil the purpose for which they are required. The object of disconnection is to prevent sewer air obtaining access to the house-drain air, because, and this is the main point, sewer air may be laden with sewer gas and disease germs. In the modern house drain it is impossible for sewer gas to be generated, and is it fair to the householder that the air from the sewers should circulate through his drains, and bring with it possible dangers which have been manufactured in the sewers themselves? The house drain can be made non-dangerous, can be well ventilated and thoroughly flushed; and when the householder has done this surely his duty is ended. The sewer likewise should be made perfect, and be well ventilated by the local authority, and should not be the means of communicating foul air, whether laden with disease germs or not, to each house which adds its quota to the sewer.

It must be granted that the disconnecting trap makes the ventilation of the sewers a greater necessity than if the sewer air were allowed to circulate through the house drains; but on the other hand, the municipal engineer can better regulate the air of the sewers if all householders' openings into the sewer are trapped.

If the disconnecting trap be omitted, the householder runs a greater risk from the openings in his drainage system. Every unsealed opening would give an outlet for possible sewer air and gas, whereas if a trap were in use it would only be the air from the drain itself which would be able to find an outlet at the unsealed opening.

The position of the disconnecting trap is important, and should be as near the sewer as possible to avoid a stagnant length of drain between the trap and the sewer.

A trap offers some impediment to the flow of the sewage, and it would be well if the bye-laws enforced the provision of a manhole in conjunction with every disconnecting trap. By this means occasional blockages could readily be removed, although it is generally found that the blockage has been caused by something that ought never to have got into the drain.

The modern trap, as perfected by years of trial, fulfils its purpose well, and if properly fixed offers little impediment to the flow of the sewage. Against all the disadvantages that can be urged the householder has the satisfaction of knowing that he is in no danger of inhaling dangerous sewer gases, and if the drain be properly used the disconnecting trap need never become blocked.

Mr. Field (Eastbourne) said that in every well-made trap there was a clearing arm. Sometimes he had noticed a stoppage in the drain caused by the blocking of the trap, and where there was a manhole it became full of sewage, and the drain being watertight it very soon ran over at the surface traps and manholes. Did anyone know of a means whereby the plug of the clearing arm could be removed without a person having to go down into the manhole for the purpose.

Mr. Price (Lytham) agreed practically with all that Mr. Ransom had written, but he thought that a disconnecting trap was not so much needed as an intercepting trap. The fresh air inlet was more often a foul air outlet, and being fixed near to the level of the ground was a source of nuisance and danger. What was required was not so much ventilation as vent, and instead of providing a fresh air inlet at the ground level, all ventilating shafts should be carried above the roofs of the houses, or to such a height that there could be no possibility of

danger from the discharge of any foul gases. On the question of trap or no trap he expressed the opinion that it would be dangerous to do away with the trap in house drains. Some influential engineers had advocated its disuse, but he thought that everyone who had had much to do with inspecting house drains must have frequently found the traps of the gullies under rain-water pipes and near to windows unsealed, and until the danger arising from sewer gas could be guarded against in a better way, the abolition of the intercepting trap would be very dangerous.

Mr. Creer (York) said he was old-fashioned enough still to believe in the disconnecting trap. Until such time as all upright pipes connected with the drain were efficiently jointed, and private drains were as well laid as the public sewers, he thought it was only right and proper there should be a disconnecting trap, with a chamber attached for access. The speaker went on briefly to describe, in reply to the question of Mr. Field, a trap which he had recently seen in use for the first time, and which made the clearing of the manhole easy without a person having to go down.

Mr. W. Kaye-Parry (Dublin) remarked that all these facilities provided for the purpose of removing obstructions otherwise than through the intercepting trap were open to the grave danger that they would provide a channel by which sewer gas could get into the house drains.

Mr. Hirst (Southport) said that in the town which he represented there were at the present time some 6,000 or 7,000 intercepting traps without any cleansing arm at all; simple gullies, with an inlet and outlet and with a cascade action. These had been in use at Southport for a great number of years, and up to the present time had given them very little difficulty. Any difficulty from stoppage that had arisen had arisen higher up the drain, nearer the house, in connection with, and usually at or near to, one of the gullies which are fixed at the end of all branch drains. All pipes, except soil pipes from inside w.c., discharge on to open gratings with gullies beneath (whether for waste or rain water) outside buildings.

The President (Mr. T. H. Yabbicom) observed that he thought Mr. Ransom had made out a good case for the disconnecting trap. He was with him, and hoped that day would not come when the sewer would be ventilated through the house drain.

CONGRESS AT BRADFORD.

CONFERENCE OF VETERINARY INSPECTORS.

THE SLAUGHTERING OF ANIMALS FOR HUMAN FOOD.

By ALFRED HOLBURN, M.R.C.V.S.,

Chief Veterinary Inspector, Corporation of Manchester.

I FEEL that I must first offer an apology to this Conference for bringing before you for discussion so revolting a subject as the slaughtering of animals for human food. I might say, however, that the subject was not chosen by myself, but by that most eminent pioneer in veterinary sanitary reform, Mr. Hunting, who is also one of the recording secretaries for this Congress, and I must candidly confess that before I commenced the work of this paper it had not occurred to me what an enormous amount of scientific interest and ethics is embodied in this subject.

To take the life of an animal is undoubtedly an act of serious importance, and the intelligent mind should strive to comprehend what must take place in suddenly converting living matter into dead.

The question of our right to kill and eat animals is one of great antiquity; even to-day the right is not unanimously admitted, we see it in the ancient idea of the "Golden Age," and at present it appears in a few conscientious abstainers from flesh.

In the earlier days, when ritual was of a most primitive kind, there was a time when an animal's life was held sacred on account of the kinship which was supposed to exist between men and gods and beasts; animals were only slaughtered for a sacrificial meal in which the god was sup-

NOTE.—The Proceedings of this Conference commenced with an Address by C. DRABBLE, M.R.C.V.S. (*see page* 204).

posed to partake along with his worshippers. This seemed to justify the slaughter.

As the desire for animal food increased, however, the sacrificial character of the slaughter was relaxed except with regard to certain species of animals which were held peculiarly sacred. Besides the supposed relation of animals to gods there was another reason why certain of them were to be avoided, viz., that they were associated with the presence of dreaded spirits. The Egyptians considered the pig unclean because the demon Set appeared in that form. We see then that among the ancients, restrictions were put on certain animals for two reasons: first, on account of holiness: the relationship to gods; and second, because of ill-disposed spirits dwelling within them: uncleanness.

As the intelligence of man advanced these mistaken and mythical ideas began to vanish, and we may say from the time of Abraham the partaking of flesh meat is approved of in Holy Scripture. Gen. xviii. 7, Leviticus xi., Matt. xv. 11, I. Tim. iv. 3 and 4.

Having now satisfied ourselves that animals may justifiably be slaughtered for the food of man, we are thus permitted to discuss how their lives shall be taken.

This investigation requires to be considered under three distinct heads, *Humanity*, *Hygiene*, and *Economy*.

Humanity.—It is undoubtedly man's duty to take care that no unnecessary pain is inflicted in taking the lives of animals. It is not the moment of death we require to ascertain so much under this head, but the moment of loss of consciousness; only the latter can be of value to the humanitarian, as with the loss of consciousness the animal no longer feels any pain. Besides, it is difficult to tell the exact time of death, for if we look upon muscular contractions as evidence of life, these can at any time be seen to take place for some considerable time after the animal's head has been cut off. Even physiology itself cannot state exactly what life is, where it ends and where death begins; therefore the most sensitive conscience will probably be satisfied when assured that pain inflicted in the act of killing is momentary.

Hygiene.—Under this head we have got to prefer that method of slaughter which (*a*) leaves the least quantity of blood in the body; (*b*) favours those physical and chemical changes in the tissues, *i.e.*, formation of lactic acid, which leads to the perfect setting of meat (rigor mortis) and hence its keeping properties.

Economy.—From the point of view of economy we require to study a method of slaughter (1) which favours an early onset of rigidity (setting)

in order that the meat is sooner fit for use; (2) which delays decomposition the longest and favours the keeping of meat in all weathers; (3) whose method is the least expensive in its execution.

On examining our subject from a general point of view the methods of slaughtering lend themselves for division into two classes only:

1st. Direct bleeding by cutting the large blood vessels of the neck.

2nd. The preliminary stunning of the animal for the purpose of sparing the animal pain in cutting the throat.

At first sight it would seem to be easy enough to decide which method of slaughter should be preferred: however, from analysis it does not seem to be so trifling a task.

It is not everyone who is qualified to decide as to the superiority of one or the other method. For this purpose there is first of all required a thorough knowledge of veterinary science and physiology and an acquaintance with the facts of surgery and medicine, coupled with a practical experience that is to be gained only within the walls of a slaughter house.

The question is not one capable of being answered from what a person might casually see nor by the ingenious inventions of a biased mind, but from what can be substantiated from a thorough scientific inquiry.

Before discussing in further detail the advantages of either way of slaughter (preliminary stunning or direct bleeding) from the points of view of humanity, hygiene, and economy, we will briefly cite how the acts are carried out.

Stunning followed by bleeding.

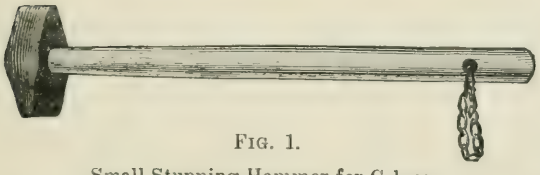


FIG. 1.
Small Stunning Hammer for Calves.

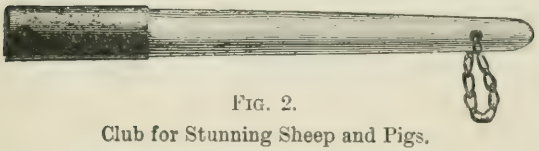


FIG. 2.
Club for Stunning Sheep and Pigs.

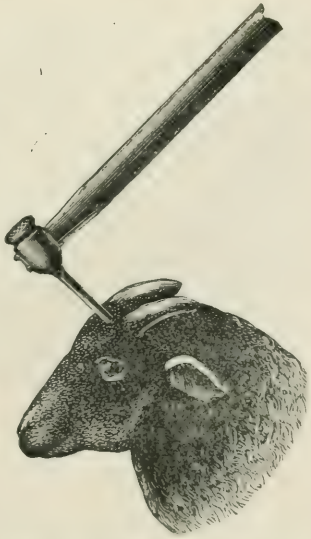


FIG. 3.—Pole-axing the Sheep.

In Great Britain this method of slaughter is chiefly applied to cattle and pigs; the animal is first stunned or felled by a blow delivered on the skull, and the large blood-vessels at the root of the neck are then opened by a knife. Several kinds of instruments are used for the purpose of stunning. First we have the small reversible hammer (Fig. 1), adopted for calves and sheep. There is also the club (Fig. 2), much used in some of the large abattoirs on the continent for sheep. Thirdly we have the common pole-axe.

The method of using the pole-axe (Fig. 3) in the case of cattle is as follows: a rope is fastened round the horns or neck of the animal, passed through a ring in the wall or floor, and drawn tight so as to steady the animal's head. In some cases the blow is delivered without the preliminary tying up. The operator, standing a little to one side of the animal,

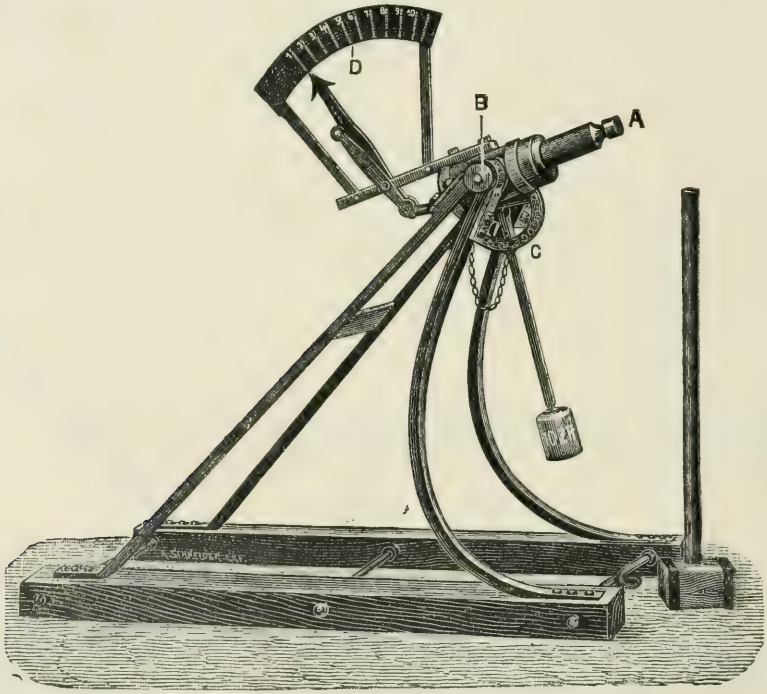


Fig. 4.—Stoff's Apparatus for Teaching Skill in Stunning.

brings the handle of the pole-axe well back over his shoulders, seizes a favourable moment when the head is still, and delivers a blow with great force on the animal's forehead. If the blow is properly delivered the

cylindrical part of the pole-axe is driven through the frontal bones of the skull into the brain, and the animal immediately drops unconscious. In some slaughter houses the blow is first delivered at the nape of the neck, and after the animal drops a subsequent blow is made on the forehead, after which the large blood-vessels at the root of the neck are cut.

Considerable strength and skill are required to accomplish this operation with anything like perfection. I have nothing to say against the operation when expeditiously done (which unfortunately is too rare), but there are many accidental circumstances to be taken into account, *e.g.*, the angle at which the blow falls on the head, the shape and growth of the horns, the age of the animal, the sex, the difficulty in securing a steady head, etc.

I would also like to point out that notwithstanding the necessity of a good marksman and a powerful blow, this experience is usually gained by practising upon the poor unfortunate animals.

In Germany several forms of apparatus have been invented for teaching skill in slaughtering, and at Berlin slaughter-houses it is compulsory for young tradesmen and apprentices to practise upon these inventions and thus attain sureness of aim and power before making a living animal the target of their attempts. Fig. 4* represents an instrument invented by Stoff, and is admirably suited for the purpose of practising, the dynamometer scale showing whether the blow was weak, medium or strong.

To guard against the accidental miscarriages of the pole-axe Bruneau, of Paris, invented in 1873 a mask (Fig. 5) made of leather, to cover the forehead and eyes, and provided with straps to fasten it on the head. A steel plate is let into the middle or frontal part of the mask and lies flat on the forehead when the mask is in position. This steel plate is perforated mesially by a strong iron tube, which is for the reception of a six-inch cylindrical iron bolt, with a flat roughened head. When the mask is fastened in position

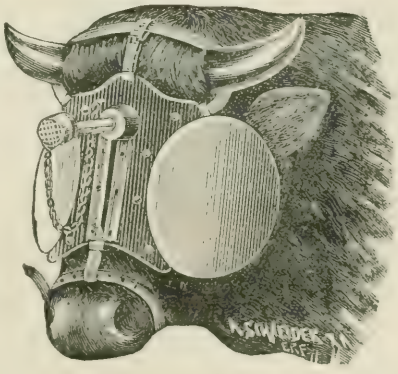


Fig. 5.—Bruneau's Mask.

* See "Public Abattoirs and Cattle Markets," published by the Ice and Cold Storage Publishing Co., Ltd., 89, Farringdon Street, London, E.C.

the head of the bolt is struck by a wooden mallet, and the deep end of it driven through the frontal bone into the brain. The effect is of course just the same as stunning by the pole-axe.

The advantages of this instrument over the pole-axe are: there is much less risk of missing the proper spot in the skull (which is only too frequent in the use of the pole-axe), and of miscalculating the force required, and this is specially the case when the operator is inexperienced.

The disadvantages of the mask are: that its application in the case of a wild or excited animal is attended with some risk to the person attempting to put it on; secondly the masks are very liable to get out of order; the bolts get blunt and are apt to rebound out of the mask or become bent with the heavy blows.

The mask does not seem to have met with anything like general approval even in Paris, although several improvements and modifications of the apparatus have been made (Boom, Erfurt Leinert, etc.).

Greener's Shooting Instrument.

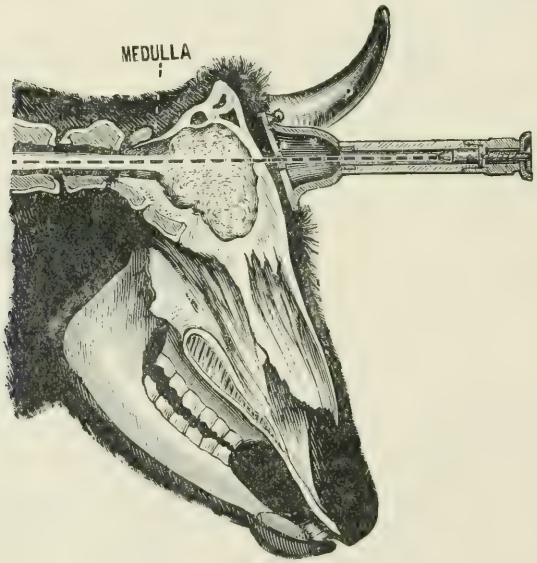


Fig. 6.—Greener's Killer, showing how the Bullet travels.

This invention is an explosive apparatus, and consists of a short rifle barrel, chambered to receive a small cartridge with steel pointed bullet. The instrument is most simple in its application, and excellent in its

results. The animal is roped to a ring similar to that in pole-axing, only the head is not drawn down so tightly. The operator (Fig. 6) rests the instrument in the centre of the forehead about halfway between the base of the horns and tops of the eyes, and with a small mallet strikes the pin of the cartridge chamber, which causes the explosion almost noiselessly, and without smoke, and the animal drops absolutely unconscious.

I am personally most favourably impressed with this instrument and hope to see its use more generally adopted. Indeed from the point of view of humanity in all countries where stunning prior to bleeding is preferred, the use of such an instrument to bulls, rough headed bullocks, and boars, ought to be made compulsory by law.

Pithing, or Neck Stab Method.

This method of slaughter is very occasionally practised in this country. The butcher stands in front of the animal, depresses its head, and thrusts a knife or pointed dagger in the nape of its neck, or the space between the occiput and the atlas, severing the cord at its junction with the medulla. The animal instantly drops and is then bled.

We can say nothing in favour of this method. It requires much skill and experience on the part of the operator and it is extremely doubtful whether loss of consciousness is instantaneous. Experiments on the dog seem to show that consciousness is manifest for a considerable time after the spinal cord at the neck is divided.

Transfixion.

This method is the one adopted in this country for killing sheep, and not infrequently for calves and pigs. It consists in plunging a pointed knife through the neck from one side to the other and thus cutting the leading blood vessels. After the throat has been thus penetrated the butcher frequently piths or breaks the neck of the sheep to stop the convulsive (kicking) movements.

It will be seen that this mode of slaughter closely resembles the Jewish method (shecheta) but is inferior to it.

Calves are usually slaughtered by first tying together their hind legs which are then fastened to a pulley and the animal then drawn up off the floor (hanging head downwards). In this position it is stunned by the blunt end of the pole-axe, or stunning hammer (Fig. 1), after which the butcher thrusts his knife into the nape of the neck, dividing the neck bones from the head, and thus piths the animal, at the same time cutting the main blood vessels of the throat.

This is a most barbarous method of slaughtering these small creatures. It is doubtful that they are even properly stunned, indeed it is not attempted in all cases, and much cutting and carving is required before the poor animal is properly bled.

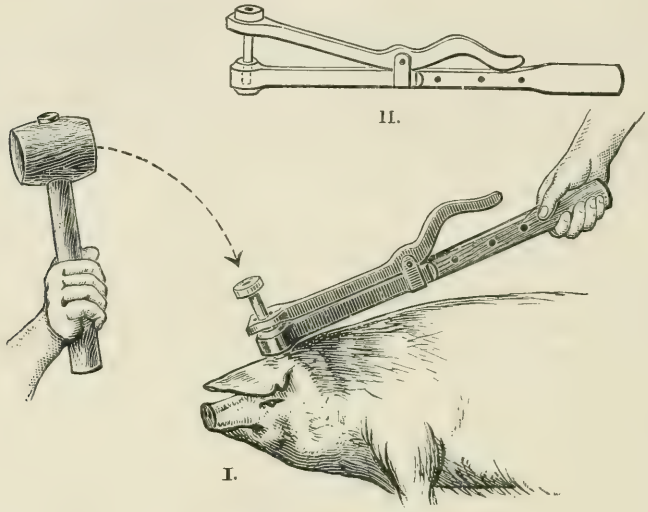


Fig. 7.—Stunning the Pig.

Pigs are usually stunned either by pole-axe (Fig. 3), or the improved stunning apparatus (Fig. 7), after which the large vessels at the root of the neck are severed. In some slaughter houses they are first hung up by the hind legs, stabbed in the throat, and allowed to bleed to death similarly to calves. In Fig. 8 there is a representation of the killing of pigs in the Union Stockyard of Chicago, from the moment that the animals are brought by means of a lift to the sixth story of the building to be killed, and finally after going through the process of every story are ready for curing in the cellar.

The English Patent Method.

This is a method of slaughter I had not heard of before commencing my paper for this Congress, and then from Continental information. It appears to have been occasionally resorted to in Paris, Germany and Russia, where it now goes by the above name; but I think it must have been abandoned in this country, the home of its birth, for a long time.

The method was invented by Dr. Jas. Carson, M.D., F.R.S., so far as I can learn about 1838, and consists in securing the animal either

in a standing or recumbent position, puncturing the chest wall between the fourth and fifth ribs, introducing the nozzle of a pair of bellows or air

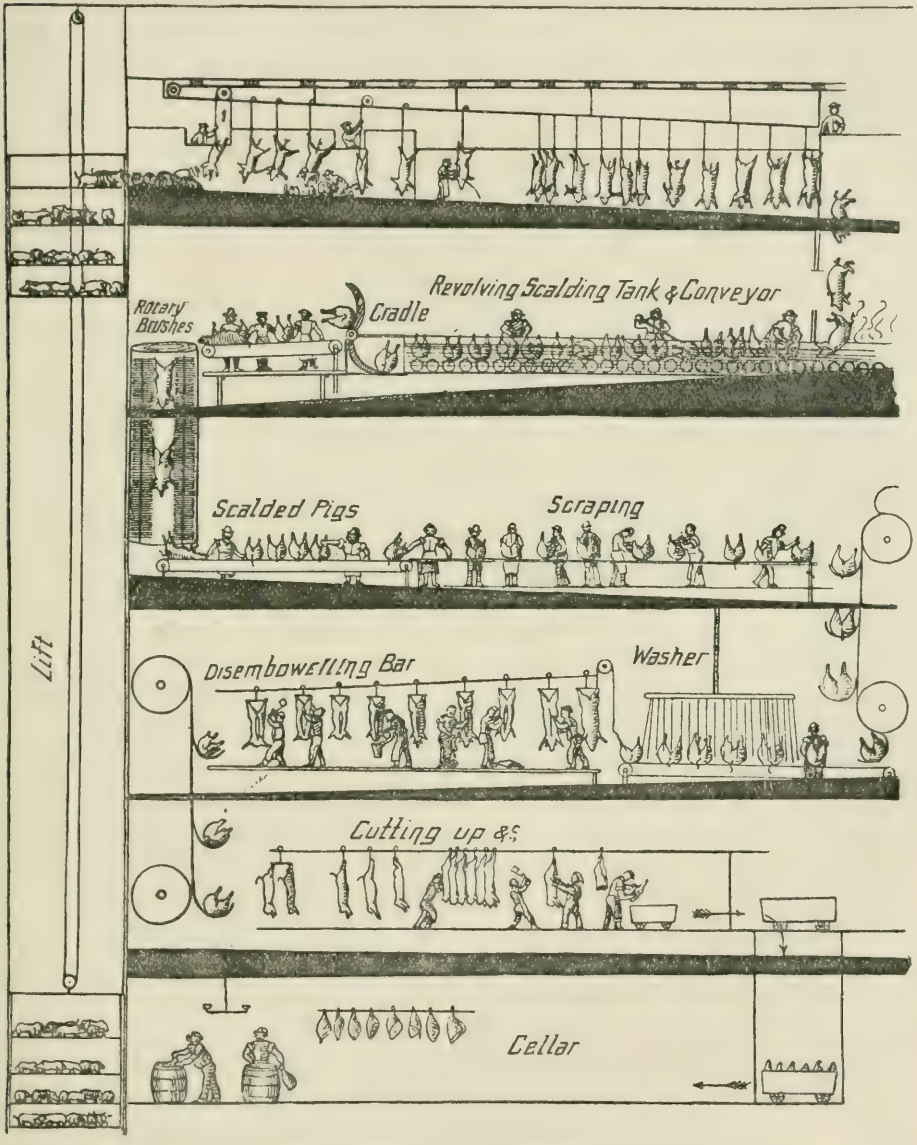


FIG. 8.—Pig Killing at Chicago, from the Slaughter to the Curing Room.

bag, and pumping air into the cavity, causing the lungs to collapse and the animal to be suffocated. The animal is not bled in the usual way.

The object of this method is that the meat shall retain all the fluids and finer juices of the body. The meat thus obtained is called "Patent Meat," and its author claims that it sets sooner, keeps longer, is more juicy, tender, better flavoured, and more nutritious. We cannot accept this method either from the point of view of humanity, hygiene, or economy.

Jewish Method of Slaughter—"Shecheta."

A method of slaughter enjoined by the Mosaic law and practised by the Jews at the present day.

Fig. 9.—Jewish Cutting Knives.

In this most ancient mode of slaughter there is no previous stunning of the animals. The Jewish method of bleeding is as follows. In the case of the ox, the animal is cast on its side, the head is made to rest on the horns, and forcibly extended so as to make tense the structures of the neck and throat. The priest, "shecheta" or cutter as they are commonly called, then takes a knife (Fig. 9) having a long straight blade (14½ inches), and as sharp as a razor, and quickly and cleanly cuts all the structures of the neck down to the vertebral column. There is thus divided not only the great blood vessels of the neck but also the wind-pipe and gullet. Sheep and poultry are similarly cut.

Most Philanthropists and Societies for the prevention of cruelty to animals look upon this mode of slaughter as wicked and barbarous, and insist upon its suppression, indeed the sight is not a pleasant one, nor is the sight of any other method a pleasant one, but we must not let sentiment cloud our judgment, and it must be remembered that our method of killing sheep differs in no material way from the Jewish one, yet its adoption is so universal and popular throughout the country that even stunning this animal would be considered cruel.

In order to decide whether the Jewish or the stunning method deserves to be preferred from a humanitarian point of view (leaving out Hygiene and Economy for the present) we must consider the following questions:

(a) How soon on an average does an animal become unconscious after both carotids and the other blood vessels of the neck have been simultaneously divided?

(b) Is unconsciousness always momentarily established in stunning, or how soon does it supervene?

Experiments go to show that the functions of the brain and in particular its grey matter, the seat of consciousness, cease immediately after the blood supply is cut off, that is to say immediately after the arteries of the neck are cut through. We know also that if the abdominal aorta is compressed, the extremities become paralysed for the time being, *i.e.* they lose power of movement and sensation: but the latter reappear as soon as the compression is taken away and the impediment to the flow of blood removed. If this occurs in the limbs, how much more marked must it be to the brain. Brown-Sequard revived the head of an executed criminal by filling the arteries of the neck with defibrinated blood. The head of a dog has been revived to motion even after being removed from the body 10 minutes.

Of all parts of our body, the outer layer of the brain is that which is most in want of food, and which is least able to stand even the slightest interference with its supply. This is the reason why in case of great excitement, when the heart stops for a time, there is a sudden loss of consciousness (fainting fit). Also in midwifery practice where the patient has fainted from hæmorrhage doctors have done painful operations which they could not have done if the patient had been conscious.

The experiments of Dr. Dembo go to show that so great a quantity of blood escapes from the four gaping vessels of the neck, and blood pressure falls so rapidly that consciousness is irretrievably lost in from three to five seconds. Also that the kicking (epileptoid) movements made after the loss of a great quantity of blood are perfectly unconscious movements and are in consequence of the anæmia of nervous system. Further the pain occasioned in cutting the animal's throat in the Jewish method must be momentary and insignificant, for their knives are surgically sharp and the part is not richly supplied with nerves.

As to the merits of stunning either by pole-axe or mask, we must remember that the skull of the ox and sheep is very resistant to blows; this is evident from the fact that their heads are also weapons of defence, moreover their brain is small and masked by two casings of hard bone between which are spaces (air sinuses). Again, severe injury to one part of the brain does not necessarily mean total loss of consciousness, the other half being capable of continuing the functions. Numerous medical works illustrate how the brain can be injured without total loss of consciousness (exemplified more especially in times of war). As I have before mentioned, accidental circumstances make it difficult to assure a deadly blow, and it is a sight too frequently witnessed in the slaughter house to see an animal repeatedly hammered at with the pole-axe before

being stunned, the point of the axe penetrating the eye socket, the nasal chamber, and other places before the effectual stroke is made. We must therefore admit that the Christian methods of slaughter are attended with much uncertainty.

From the point of view of hygiene, the Jewish method of slaughter is also more commendable. The blood flows much more freely, there being no paralysis of the vasomotor nerves, and the meat is, therefore, better bled. Again, in the rapid out-flowing of blood, more oxygen is removed from the tissues, this, with the animal's unconscious movements, favours the acid re-action of muscle which is necessary for the production of rigor (setting). The early onset of this re-action is also desirable, inasmuch as it impedes the growth of micro-organisms, hence the delay of decomposition. The phenomenon of setting-rigor mainly depends upon the appearance in the flesh of lactic acid, which causes the coagulation of the myosin; for only after the appearance of lactic acid and the setting in of the rigor does the meat become tasty, tender, and digestible.

The laboratory experiments of Dr. Dembo also show that rigor sets in quicker in meat slaughtered by the Jewish method and lasts longer, hence decomposition does not so soon become evident.

A conscientious analysis, both scientific and practical, of the way by which our domesticated animals are slaughtered for the food of man, can only come to one conclusion, that the present state of things is very unsatisfactory, and solemnly and urgently asks for an immediate and national inquiry, the outcome of which would bring peace and comfort to distressed minds.

The pole-axe can only be considered humane when the animal is stunned by the first blow. The mask is better, but dangerous, and sometimes impossible to fasten on the head. Greener's cattle killer, however, is reliable, when circumstances permit of its use; lastly, weighing all things together, I am of opinion that the rebuke given to the Jewish method by the Society for the Prevention of Cruelty to Animals and other objectors, is undeserved, either from a humanitarian or hygienic point of view.

In conclusion I desire to express my appreciation of the kindness shown me by the publishers of "Public Abattoirs and Cattle Markets," who have kindly supplied me with the illustrations. I am sure that English readers are indebted to the editors of this work for the practical information contained therein; also to Dr. Dembo's most instructive and valuable work on this subject.

The President (Mr. C. Drabble) said it seemed to him, after hearing Mr. Holburn's paper, that the Jewish method of slaughtering animals was a most satisfactory one. Previously he had always looked upon it as a most barbarous way of despatching animals. He thought that if some other means of fastening the animal to be slaughtered were adopted the operation would look much better.

Mr. J. B. Wolstenholme (Manchester) said that the question of killing animals appealed to everyone: to the layman from a humanitarian point of view, and to veterinary inspectors from that standpoint as well as the exigences of the trade. He had often considered how to discover a better method than the ones at present in vogue, for he was one of those individuals who had had such a frightful sickening in watching the killing of horses with the pole-axe or hammer by incompetent men. Personally he preferred the use of a gun to the pole-axe for horses. Now, he had some little experience of the Greener's killer, and had nothing to say in respect of it but commendation. For the veterinary surgeon it was one of the most humane means by which a horse or an ox could be put to death. One defect, however, which he had noticed was that the strength of the explosive was not always sufficient. On one occasion he exploded the instrument twice, firing two shots, and the bullets did not penetrate the brain. He thought the cartridges must have been at fault. The instrument, however, was perfectly safe, and was a valuable addition to our means of killing. He was pleased that the question of training apprentices and novices had been brought forward. There should be some means devised for compulsory education in these matters. Men ought to be taught on some dummy, or on an instrument such as had been described in the paper just read, and given a more or less preliminary training in the slaughtering of animals. The question of the Jewish method of slaughtering of animals was one which he had puzzled his own mind about very considerably. He had never, however, focused his ideas upon it until that morning, when he had been helped very much by Mr. Holburn's remarks. It was when one came to reflect that it was clear that the sudden removal from the brain of such a volume of blood must almost instantaneously produce unconsciousness in the animal. To him the method was a most revolting one. He would not like to be present while it was going on; but in justice he was bound to admit that, logically, it provided practically as useful and sudden a method of causing unconsciousness as did the method of stunning. The subject was one which not only needed to come before them, but also in a more extended form before the public at large.

Mr. W. Hunting (London) said that perhaps one did not notice at first the sarcasm contained in the phrase that only the larger animals were stunned prior to being bled. Ox-stunning was not carried out from a humanitarian point of view at all; it was absolutely for the protection of his own bones that the butcher stunned large animals. The miserable sheep was kicked about in any manner,

and in this country was killed in a most abominably cruel way. A knife was pushed into the neck, and then one saw the butcher feeling for the arteries, and sometimes he tried to break the poor thing's neck. He repeated that sheep killing in most of the places in this country was an abominable disgrace. In Paris the sheep were put to death in precisely the same manner as the Jewish butcher killed cattle. With one stroke of the knife he severed the nerves and arteries down to the bone. Surely if in the sticking process only the arteries were divided it was a very much more easy and thorough method to draw the knife across the animal's throat. Even calves were killed in Paris by having their throats cut, and a man never made a mistake by that method. Bearing upon the matter of the stunning of the smaller animals, the pig was not such a small animal, but in some cases he was stunned because he made such a horrible noise. The English patent method of preserving meat had been mentioned. He would rather resent its being called an English method. It certainly had not been adopted here to his knowledge: he did not know any part of the Kingdom in which it had, and he did not think he had ever met a butcher who had even heard of it. He agreed with Mr. Holburn that the Jewish method of slaughtering animals was not so bad as was made out. The worst features were the fastening and casting of the bullock. They were cast on stones without a cushion to fall upon. The animal's horns, too, had a very bad time of it. The animal was cast upon the ground and the head was pressed back in order to draw parts of the neck tight. This might be necessary for the purpose of more easily severing the arteries. Barring the over-stretching of the neck and the rough casting he thought that the Jewish method was not wanting in humanity at all. As to Greener's Killer, the great advantage of the instrument was that any novice could use it so long as he knew exactly the spot upon which to place it. Of course if a man thought that that spot on the forehead from which the hair diverged was the special mark for the brain he was making a big mistake. He had somewhere seen a good suggestion regarding a means of locating the proper place on which to strike an animal for the purpose of stunning him. The suggestion was to draw two lines from the root of each ear to the opposite eye and where the two lines crossed each other would be found the spot on which to use the pole-axe. In London, Greener's Killer was used by the horse slaughterers. In the streets it was objectionable because it always caused a lot of blood to flow down the nose. That, of course, was not so objectionable in the slaughter-house. Another drawback was that it was not easy to gauge the exact strength of the explosive. There was a considerable variation in the thickness of the heads of animals, as there was of humans. Some of them required a heavier charge than others to penetrate. The thickest skull must be provided for, and then there was the danger that in the case of a thin skull the bullet would penetrate very easily, and if the animal should move his head a little to one side the bullet would come out on the convex side of the neck. This rendered it a little dangerous for use in the streets, and it would be particularly dangerous in

abattoirs which were open, and where say fifty men were working in one place, because some one might easily be hurt. There was an implement in use in some of the slaughter-houses abroad which was on a similar principle to Greener's Killer, only instead of propelling a bullet which left the instrument, it propelled a bolt which was prevented from doing so by a shoulder, so that it acted exactly in the same way as a pole-axe. The bolt was driven by an explosive cartridge and penetrated the brain without escaping from the gun. Whether it could be arranged to do for large animals he did not know, but in the case of small animals it did its work remarkably well.

MR. HOLBURN (Manchester), replying to the discussion, said he regarded the Jewish method of slaughter as being far more humane than most people thought. This was probably because the method had not been analysed from a scientific aspect, and secondly because most observers allowed sentiment or passion to cloud their judgment. It must be remembered that animals are not easily stunned on account of the anatomy of their skulls; this would also be more easily understood when he said that the head of an animal is its weapon of offence. The question is, on which of the two animals is inflicted the most pain, the animal that is struck two or three blows on the head with the pole-axe before being rendered unconscious, or the animal that receives no blows, but is immediately rendered unconscious by expeditiously cutting through the large blood-vessels of the throat? As he said before, immediately the blood leaves the brain there is loss of consciousness, hence no pain. Besides, we do not stun sheep in this country; yet no one can deny that the Jewish method of cutting the sheep's throat is more humane than the Christian method. The great drawback to the Jewish method is the casting and fastening of the cattle, which leaves much to be desired. We would all welcome the invention of an apparatus that would more agreeably meet this difficulty. With the Greener's Killer mistakes had been made through placing the instrument too low down. He liked Mr. Hunting's remarks as to the manner of finding the spot on which to place the instrument on the skull. Several strengths of the Greener Killer were now made to meet the requirements of the different sized animals. He also emphasized the necessity of training butchers' apprentices to the power and accuracy of stunning on an apparatus, similar to the one shown in his paper, before attempting to stun large animals, or in other words, making the living animal the target of their training.

THE COLLECTION, DISTRIBUTION, AND CONTAMINATION OF MILK.

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IN adopting such an ambitious title, I hope I shall not mislead any of you into thinking that anything like a complete dissertation is to be given under the headings named. I merely intend to draw your attention, somewhat roughly it is true, to the main evils of our milk supply—the scope of a paper like this will not allow of anything more, and I hope that if necessary you will not hesitate to criticise me as roughly as I have handled the subject.

To some extent the hope for improvement in this great trade lies with the veterinary surgeon. I omit the title Inspector, and refer more particularly to the veterinary practitioner; a little quiet advice given by a practitioner to his own client is far more likely to be listened to, and acted upon, than advice given by a man whom the farmer has never seen before, and possibly may never see again, and whose advice is treated with that suspicion which is characteristic of the farming class; to a great extent the farmer ridicules reform and progress by arguments such as "Well, it has never done us any harm," therefore it is to his mind impossible that such an effect is ever likely to arise.

If one is at all keen on argument, and proceeds to demonstrate to him the fact that he and his have lived under very different circumstances to a large proportion of the town dwellers, and so on *ad infinitum*, it carries but little, if any, conviction, and he is not taught anything.

Cow's milk is to a very great and increasing extent the staple diet of our infant population; the infant death-rate is a terrible and never-ending source of anxiety to our medical officers of health, and anything which might help towards a decrease in this death-rate would be of enormous importance to the community.

Every summer we have a tremendous infantile death-roll from epidemic

diarrhœa, and our health authorities are busy doing what they can to combat it, with little result. Ever since I was appointed to the post I have at present the honour to hold, I have been more and more struck by the great want of all method in the milk industry. I am dealing now particularly with the farmers themselves; they seem to live in a kind of happy-go-lucky land, observing sincerely the old quotation that "sufficient for the day is the evil thereof."

A great factor, in my opinion, conducive to the state of affairs is the fact that to a very large extent the milk trade is in the hands of the illiterate and poorer class of farmers, whose great necessity is ready money, and who have had to take to milk selling as a last resort. Perhaps a considerable number have no knowledge of milk production, their farm being only suitable for feeding cattle.

To this class, reform of every description is particularly obnoxious, to some extent because reform means expenditure; unfortunately this is a great difficulty and presses, in some cases, rather heavily on the farmer, and also they are prejudiced and resent interference, to what extent none but those who are brought into daily contact with them are aware.

I do not desire, for a minute, to have you imagine that I am condemning every dairy farmer, for I am thankful to say that in my time I have met a considerable number of enlightened men engaged in the business, whose methods are scientific and the results are profitable; I wish we had a very much greater number of such men. We have of course some companies, such as Welford's and the Aylesbury Dairy Co., who will not buy milk from bad farms, but have their supplies under very strict contracts, and employ large staffs of trained scientists, among whom are a considerable number of veterinary surgeons. These businesses pay handsome dividends.

I might say that so far as my experience takes me the milk trade is in a filthy condition; in the British Isles we have, or are supposed to have, the finest herds in the world, the pastures are good and the climate suitable; with a basis of these conditions we ought to be models for the rest of the world.

In proceeding to deal with the subject proper, I propose to take collection and distribution together, as I have thought it inadvisable to separate the two.

For the collection proper we must visit a dairy farm, and see the actual condition under which milk is collected.

We possibly have a nice herd of milking cows (or which would be very nice if they were clean) standing in cowsheds with floors and walls coated with filth; the cows from whom the milk is to be obtained are in a great

number of instances very dirty, rarely is it you can say you have inspected a herd that was very clean. The construction of the majority of cow-sheds makes cleanliness a matter of the greatest difficulty; the cows' udders may be dirty, the tail (which is being whisked about) is also dirty, and likewise the quarters, particularly in the winter months.

Then come the milkers, possibly bringing extra cans which are set down, either in the cowshed or just outside, in close proximity to the middenstead; each obtains a stool, and proceeds to work; he rubs possibly each teat over with two fingers, this is to some extent a cleaning process; he possibly thinks that it would be better to damp the teats with milk, this is soon done by drawing a little milk into the can and dipping his fingers in.

The milkers are often a most nondescript collection, and usually include a boy or two.

You will find men coming direct from their work, whether they may have been at work in the field, or emptying manure, or any of the hundred and one jobs which fall to the lot of the farm labourer; and sitting down on their milking stool and proceeding to milk without washing their hands. Then again, their clothes are not exactly fit for a drawing-room, nobody expects that they should be—but what is more filthy than the foregoing combination: dirty udders, dirty hands and dirty clothes; and yet we expect to get clean wholesome milk. I very much regret the passing of the female milkers, one used to see them in a nice clean milking smock, and usually with clean hands; they were infinitely cleaner in every way than men-milkers.

I do not say that it is impossible to get your men-milkers to be cleanly; but so long as they are left to please themselves to the extent they do at present, so long will these conditions exist.

You may say all this is legislated for in the Dairies, Cowsheds and Milkshops Order; but how many local authorities carry out this Order as it should be carried out. I do not say that it is a satisfactory Order by a very long way, but still it is better than nothing. The adoption is to a very great extent optional, and you may pass through the country and see rural districts, side by side, one having adopted the Dairies, Cowsheds Order, and the other not having done so. At this time of the year, it is usually possible to tell where it is adopted because the local sanitary inspector in whose district the Order is in force, urges white-washing; but so far as my experience goes, the Order in the country districts is a dead letter. It is easily understood when you consider that the local board is composed to a great extent of the farmers themselves.

In a city like Manchester one is able to carry out the Order pretty thoroughly; though constant supervision is necessary on the part of the veterinary inspector and also the district sanitary inspector.

But to return to the cleanliness of milkers and their clothes. I think it should not be too much to insist upon, every milker washing his hands, and that a heavy penalty should await anyone caught milking with dirty hands. In addition, they should all wear milking-smocks.

At most farms it is the practice to cool the milk before despatching it to its destination, and for this purpose a refrigerating apparatus is fixed in some shed in the yard. You have doubtless seen the arrangement yourselves, a long, irregular tube through which water is passing, and the milk is allowed to run down the outside. These sheds containing the apparatus are often used for additional purposes, such as washing clothes, storing coal, &c. They are usually open sheds, into which all sorts of dust may blow at will.

I might say that the cooling of milk from the town cowsheds is almost unknown. For this the public are really to blame as they consider that warm milk is the best, and will insist on having it so.

This refrigeration of milk is one of the most unsatisfactory features of the methods of handling milk as at present in use. We know now how very necessary it is, especially in the summer months, that milk should be thoroughly cooled as soon as possible after being taken from the cow. It is, in fact, one of the greatest safeguards we have.

It is, however, done on the whole in a very rough-and-ready manner. the water used for cooling purposes often being very nearly as warm as the milk itself. This is especially the case where the water is stored in a large cistern in the upper part of the shed, the roof of which is corrugated iron.

Refrigeration or cooling ought to be carried out in a proper room or dairy, which should not be open and should be used for no other purpose than for dealing with milk. The question of effectual refrigeration requires attention. At present, however, it does not seem possible to effectually refrigerate the milk on the farms, particularly the smaller ones, on which the water supply is very primitive: for instance, in some hilly districts, such as Derbyshire, the only water the farmers have is collected in small reservoirs excavated in the hill-side, and they are often filled with surface-water; they are exposed to the heat of the sun, and the water gets very warm, and so it is impossible to cool the milk.

The milk from the refrigerator passes into a large can or tankard, over the mouth of which is stretched a piece of muslin. As each can is filled, the lid is put on—in some cases the lid fits tight, in some it does not: a

label is affixed, and it is ready for the train or cart. Occasionally you may find a farmer seals the can, but very rarely; the seals are cheap, and prevent the milk being tampered with *en route*, and should be in general use. There is an idea, however, that railway companies charge more for carrying sealed cans, though, so far as I am aware, there is no railway which makes such an extra charge.

With regard to the distribution of milk we have to consider first by rail and later by hand or by cart.

The railway companies are now catering considerably for the dairy farmer, inasmuch as on some railways a train is run especially for the carriage of milk.

The railway companies should, however, go further and provide proper vans for the conveyance of milk, vans which should really be refrigerating or cold air vans; further, at all stations where large quantities of milk are dealt with proper cold air stores should be provided for keeping the milk, even though it has only to remain in the station some short time: very often, however, milk is brought in at night and not taken away until the following morning, and is left either in a truck or on the platform all night.

A large quantity of the milk sent to a town goes to various milk shops which are in need of urgent attention. Without entering into the question of milk shops, I may say that the indiscriminate way in which persons whose habitations are absolutely unfit, and whose conveniences for storing milk are nil, are allowed to register for the sale of milk, is lamentable. We all have experience of the miniature Stores met with in the slums of our towns; such combinations as fish, vegetables, tobacco, and milk, are fairly common, and the shops usually filthy dirty. This subject of houses registered for the sale of milk is a very large one, and if dealt with at all should be dealt with thoroughly and without any sentimental panderings to a prejudiced community: a proper scheme of requirements should be formulated, not a difficult matter, and this should be adhered to. In considering this subject the municipalisation of the milk supply is bound to crop up: whatever is done it will not be before time.

The delivery of milk by means of carts is worthy of consideration, the usual method is to put one or two large cans on to a cart, and then to take off the lid and dip in for the quantity required. Surely this is most primitive, and it would be better if milk were drawn out by means of a tap, the vessel being a covered one.

Absolute cleanliness in all vessels should be insisted on, the milk-dealer should clean the cans before returning them to farmers. These milk-dealers

often take away a can to their dairy, keep it for a few days and then return it, the can being then in a horrible state and very difficult indeed to clean.

Under the heading of Contamination I come to the most important part of my subject. We may, I think treat contamination under two headings, (1) contamination from the cow herself, (2) contamination from other sources.

In contamination from the cow I merely refer to conditions that are commonly found affecting the udder, such as tuberculosis, actinomycosis, abscesses, mastitis, etc.: it is no use discussing any of these. I had intended saying something about tuberculosis, but the question as to whether it is, or is not, dangerous to man is sub judice and so best left alone.

Under contamination from other sources, the milker is a potent factor in the conveyance of such diseases as scarlet fever, diphtheria, enteric. I might here say that I do not consider that the cow herself will suffer from these diseases. I know a number of authorities are of opinion that certain lesions found on the cow's teat may be diphtheric. I do not pose as an authority, but have never yet been able to satisfy myself that such lesions have any connection with diphtheria. If it falls to the lot of a veterinary surgeon to follow up any cases of this kind, he should always inquire closely into the health of all the individuals on the farm; though so far as human beings are concerned it is necessary that a medical man make these inquiries and take swabs from their throats, etc.

It is also, I think, possible for the milk to become contaminated by a consumptive milker, and on no account should a consumptive be allowed to milk.

Fæcal contamination. This may arise by dirt directly falling into the milk during milking, and no doubt this is often the case; particularly serious is the contamination likely to be, if the cow has suffered from any intestinal affection.

In a recent paper, Professor Delepine says:—Such fæcal contamination does frequently occur, as can easily be ascertained by inspection of badly kept dairy farms, and by the bacteriological and microscopical examination of milk. It is even difficult to conceive how slight fæcal pollution of cow's milk can be prevented under any circumstance. Under ordinary conditions the contamination is apparently without serious effects; but when some animals in a herd are affected with intestinal inflammation, virulent bacilli must escape from the bowel, and more or less directly affect the milk, when that fluid is not collected under conditions of strict cleanliness.

In summer, bacteria find in milk a suitable medium for rapid growth and multiplicaation, so that milk, originally wholesome, may be rapidly rendered noxious.

While considering fæcal pollution, we must turn to the water supply at the farms. In Manchester, so long as the municipal supply is somewhere handy, we require it to be laid on to the farms. But at the country farms the water supply is a very serious matter, and there is little doubt that it is far more extensively polluted with sewage than was originally thought.

At many farms the drinking water for the cattle is too filthy for anything; in many instances the pool containing it might be described as nothing less than an open cesspit. If this fæcally-polluted water is used, as it is in many cases, to wash out the cans, we have a means of producing contamination of the milk to an alarming extent. The cans are usually first scalded out with boiling water, and then swilled out with cold, and a small quantity is nearly always left in the can.

We have recently had two cases in which we were able to prove that the water was polluted, and the pollution had shown itself by producing through the milk acute septic infection of the guinea pigs inoculated, within a short time after inoculation.

In one of the cases, when I visited to investigate, in addition to finding that the pump water was polluted, I found that into a small stream, I call it a stream out of courtesy, at which the cattle had to drink, all the sewage from four houses was emptied, and all within 100 yards of the farm I was inspecting.

I have already mentioned the water supply as found in the hilly districts. In the small basins or reservoirs which have frequently to supply cattle and human beings alike, I have frequently seen cattle standing in the water contained therein. They are glad to stand in them in the summer months, and needless to say both defælcate and urinate directly into the water.

If it is not possible to devise any other means of supplying water it is surely not too much to ask that these basins be railed round, and that a small trough be constructed adjacent to the reservoir, and connected to it by a pipe.

To show the extent of the bacterial contamination of milk, I may quote some figures from a paper on "The Great Bacterial Contamination of the Milk of Cities, &c.," by Dr. W. H. Park. For our purpose the first four groups mentioned will be sufficient.

In Group I. the milk was obtained from cows with which every care was taken to ensure cleanliness. The milk was cooled within one hour after milking, to 45° F., and subsequently kept at that temperature. There were six specimens obtained from six individual cows, the average number of bacteria in 1 c.c. of milk three hours after milking was 6,000, at the end of 48 hours the number was 17,816.

In Group II. the milk was taken in the winter in well-ventilated, fairly clean but dusty barns, visible dirt was cleaned off the udders, milkers hands were wiped but not washed. milking cans were clean, but straining cloths were dusty. The milk was cooled within two hours of milking to 45° F.

In this group, at the time of milking, the average number of bacteria in 1 c.c. of milk was 15,500; at the end of forty-eight hours the number had increased to 76,000 per c.c.

In Group III. the milk was taken from cows in ordinary byres; ground thickly covered with manure; the cows more or less visibly dirty. The teats were cleaned more or less slightly by just running the unwashed hand over before milking; pails and cans clean; and the milk was cooled to 45° F. within two hours after milking.

Under this group there are two distinct experiments: one, Experiment A, was carried out in the summer, and the other, Experiment B, in the winter. In Experiment A the average number of bacteria in 1 c.c. of milk, shortly after milking, was 30,360; at the end of forty-eight hours the number had increased to 680,000 per c.c. In Experiment B the number at milking was 16,650, and at the end of forty-eight hours this had increased to 210,000.

In Group IV. the figures are given of counts taken in the case of ordinary mixed milk taken on arrival at one of the New York railway stations. The temperature of the atmosphere averaged 50° during the preceding twenty-four hours. The temperature of the milk when taken from the cans averaged 45° F. Ten samples were taken, and the average number of bacteria found in 1 c.c. of milk was 5,933,500; these samples had travelled an average of 200 miles.

You will have observed that in the first three experiments above given the milk was reduced to a low temperature; in the last experiment the temperature was not high. So that we may look upon the experiments, with the exception of the last one, as having been made under abnormal conditions.

In a later table figures are given of observations on bacterial multiplication in milk at 90° F., a common summer temperature in New York.

In sample No. 1 the milk was obtained fresh, and was of good quality: the number of bacteria in 1 c.c. was 5,200. Eight hours after the number had increased nearly 700,000.

In sample No. 2 the milk was of fair quality, and was obtained from a milkshop: the number of bacteria in 1 c.c. here was 92,000 at the time it was taken; eight hours after it had increased to nearly seven millions.

In the third sample the milk was of bad quality, and also obtained from a store, here the original number of bacteria was 2,600,000, but at the end of eight hours the number was one hundred and twenty four millions.

The conditions I have described in the country are practically the same in London, and it was shown in a paper published in the *Lancet* some three years ago, that the average number of bacteria in London milk, was 3,000,000 per c.c.

Many might say that this bacterial contamination is not preventable. It certainly is not feasible to obtain milk absolutely free from bacteria, without any, or but very slight increase in expenses. I contend that it is possible, nay we should demand milk of very much better quality.

What is required? the quotations given speak for themselves; cleanliness in everything, and refrigeration, or proper cooling to at any rate 40° F. With these conditions we should get milk twenty-four hours old with not more than 30,000 bacteria per c.c.

Fresh milk has certain bactericidal properties which are capable of inhibiting the growth of bacteria, at a low temperature these properties act efficiently, providing the milk is not filthy, for from twelve to twenty-four hours, but at higher temperatures their effect is lost, and the bacteria in milk rapidly increase.

There is little doubt that milk containing these large numbers of bacteria is dangerous to health, and a standard should be fixed say at 30,000 per c.c., and milk giving much beyond this number should be dealt with. At any rate the farmer should be cautioned. In New York the Sanitary Authorities are working on these lines, and it will be interesting to see the result of their work.

Contamination in the house of the consumer I do not intend to deal with in this paper.

MR. J. S. LLOYD (Sheffield) remarked that at the present time in country places some cowsheds were simply abominable. One way in which they might attempt to obtain the production and supply of milk under better conditions was to set about improving these cowsheds. If restrictions were put upon the use of them and were enforced, we should have greater cleanliness, better ventilation, and increased light. In country places the water supply was a very difficult question, no doubt. He could only say that he wished it was possible to get a proper supply of pure water to country cowsheds. Regarding the question of contamination of milk, it was well known to people who had considered the matter, that if milk was quickly cooled to a low temperature there could be very little increase of the bacteria until after the first six hours. His experience, after visiting large numbers of dairies and cowsheds, had led him to consider that the conditions found prevailing in the cowsheds in towns were very much better than in country places. He thought that the municipal authorities ought to encourage the town cowkeeper as much as they possibly could. These people usually kept their cows in good sanitary buildings. The milk was also delivered straight to the consumer, which was in itself a very considerable advantage. If the consumer could secure milk within twelve hours of its production there was then not so much danger from contamination. As to the point raised in the paper regarding milk being sent by rail in sealed cans, in October 1889 a letter was sent to the railway companies by the Chamber of Agriculture, or some other large body, bearing upon the subject. The railway companies agreed that milk should be sent in sealed cans, imposing only one proviso, namely, that the quantity of milk in each can should be clearly marked on the outside of such can, in order that the weight might be tested at any point on the journey. The municipal authorities had done their best of late years to provide sterilised milk. In America they had what was called certified milk. One of the points in connection with this system was that the premises on which the milk was produced had to be open for inspection at any time. As stated in the paper, the milk must not contain more than 30,000 per c.c. of bacteria. Regarding diseases of the udder, to show how careless farmers were in milking, he would relate an experience: He went to a farm in Cheshire some two or three years ago to examine a herd of cows from which tuberculous milk had recently been sent to Manchester. In the course of his examination he found one cow just starting with mastitis, the milk from the affected quarter being a little curdled. The farmer admitted having milked this cow himself not an hour before, but stated that he had not noticed anything wrong with the milk. The curdled milk had been mixed with that from his other cows and had been sent to Manchester.

MR. HICKES (Market Weighton) said that the question was to a large extent one of finance. The milk dealer had to live, and if he had to pay for the cost of improving his premises, and the conditions generally under which the milk was

produced, he must have more money for his milk. When the man who provided good milk received more money for it the milk supply would improve. At present the bad producer received as much as the good one. It rested with the consumer alone to bring about reforms. Laws might be made but the difficulty then arose of enforcing them.

Mr. J. B. Wolstenholme (Manchester) remarked that if there was one subject more than another which veterinary inspectors should be able to discuss it was this question of the milk supply. He was pleased that the financial aspect of the question had been raised. He thought that, taking into consideration the whole of the various interests involved in the collection and distribution of more or less pure milk, we were driven to one conclusion only, that legislation which was local and legislation which was permissive were valueless, or comparatively so. He had long thought that what was necessary for this, and for sundry other questions connected with the health of animals and the correlated health of human beings, was not a local or permissive method of dealing with it, but a general and national one. What should be done, in his opinion, was to institute a national system, whereby the farmers should be instructed, and whereby proper supervision should be given to the distribution of the milk, and that those who would not comply with reasonable conditions should be punished or prohibited from cow-keeping and from distributing milk. If a national system of this sort were in operation, and those who would not conform to the regulations were weeded out, then any enforced expense of production and distribution would fall upon the consumer; and the consumer, in his opinion, was not ill-disposed to pay a better price for milk when he knew that the advantages under which it had been produced more than compensated him for the higher charges which he was called upon to pay. Speaking of the horrible conditions under which milk was produced in many places, he instanced having gone to farms and seen human excreta and other filth within fifteen yards of the cowsheds where the cows were being milked. A strong wind would be blowing, perhaps, and the whole atmosphere would be reeking with the stench produced by this filth. Then as to the actual work of milking: Men came often from the very dirtiest of dirty occupations, their hands loaded with all kinds of bacteria of putrefaction, their clothes in a dirty state, to do the milking. On farms he had known there was no attempt made at refrigeration. It was in the cooling immediately of the milk, and the keeping it cool until it came into the hands of the consumer, that the greatest improvement was to be brought about. He did not know whether veterinary inspectors could ever rouse the country sufficiently to produce a cry for legislation, but he was sure that some means of the sort should be adopted by the veterinary and medical officers in order that the evil might be dealt with nationally.

Mr. James East (Aylesbury) said he fully indorsed everything that had been said with reference to the filthy conditions and surroundings of the cowsheds in

country places, the filthy water provided for the cattle, and also the filthy condition of the men who had to attend to them. It was no uncommon sight at all to see the dirt squeezed between the fingers of the men who were milking and drop into the can containing the milk. Then, again, he had seen a piece of canvas stretched across the top of the pail, through which the milk percolated. When this canvas became clotted with dirt he had seen it rinsed in the milk. This was a horrible state of affairs, and ought really to be put a stop to. To his mind it was remarkable that the result of such a condition of affairs was not worse than it already was. He was one of those who believed that the time had come when legislation should be brought to bear with firmness, and so be beneficial to the country at large. Every dairy should be properly constructed, both as regarded its cattle accommodation and the sanitary condition of the farm. Unless the landlord or the tenant, or both, would agree to the suggestions made they should certainly not be permitted to sell the milk from off the farm. One question had struck him very forcibly on the previous evening, when listening to the inaugural address by the Earl Stamford. It seemed to him that the time had come when our young people should be educated in these matters to a much greater extent than had been the case in the past. He thought that by doing that, something, at any rate, would be done towards arresting these evils. Speaking with reference to his own district the farms there which supplied milk to the Anglo-Swiss Condensed Milk Company were compelled to have refrigerators. In conclusion, he said that it was time the veterinary surgeons of the country made their voices heard in the matter under discussion.

Mr. A. L. Butters (London) said it had been suggested to his mind that if the municipal authorities would only encourage town dairies, a great many of the troubles which had been pointed out, such as the dirty surroundings causing milk contamination, would be avoided. The cow was a domestic animal, and he saw no reason why it should be banished from our towns to the country places. He thought that if our municipal authorities were really to encourage the establishment of small dairies in the towns we should then have distributing centres, which could be kept in a sanitary condition, as they would be open to inspection. The effect on the animals would be to keep them in better health. The water supplied to them, for instance, would be the same as that which we drank ourselves. The milk produced under these conditions would be pure and wholesome, and could be served to the public in that condition. Some of our large towns, Liverpool, for instance, had such establishments. Some years ago the milk was tested in Liverpool for tuberculosis, and it was found that town milk was superior to that supplied by the country districts. He knew that the whole of the milk supply of a town could not be produced in the neighbourhood, but he thought that the establishment of small dairies to be kept under healthy and sanitary conditions would be a great advantage, not only to the infant population but to the public at large.

Mr. H. J. Dawes (West Bromwich) gave an instance of a farm he had known, which for a large number of years was tenanted by a certain man whose milking cows began to waste away. It was afterwards discovered that the fæcal matter from the cowsheds and the farmhouse went into a drain which passed in turn into the water which the cattle had to drink. The attention of the medical officer was called to the matter and the defect was remedied, or rather, another system was adopted. A large tank was built within 80 yards or 100 yards of the cowshed, and into this all fæcal matter was cast. The tank was to have been emptied every day, but the greatest possible difficulty was experienced in getting the farmer to do this.

Mr. W. Hunting (London) said that a little while ago he had something to do with a large shed of cows just outside London. The owner thought he would try to get rid of tuberculosis amongst his cows, and he spent £400 in the attempt and occupied thirteen months of his time. He succeeded, and then he thought he would get a halfpenny per quart more for his milk. He could not get the price he asked, so that the £400 was simply wasted so far as he was concerned. The British public would not pay the extra money. The fact was that one of the great difficulties in the way of reform was ignorance. It was only a few years ago that the medical profession recognised that tuberculosis was due to definite organisms. It took about three generations to get rid of any error. What was being done now was about the only thing which could be done, attempting to spread the light. He urged that the gospel of sanitation should be taught till the people understood it. Legislation could do something; it had great educational advantages. If a man was told the law provided punishment for some of his transactions it would do him a great deal of good, and he would realise how pleasant it was to walk in the right path. The only protection the public had at present was the Dairies and Cowsheds Order. Under that Order, when an animal had a tuberculous udder, the sanitary officials could, if they took the trouble, make the owner get rid of the animal. But in this same shed you might probably find two other animals, one on each side of the affected animal, one with a bad cough and the front of the wall all plastered with mucus, food, and innumerable bacilli, another on the opposite side suffering from intestinal tuberculosis, its quarters and legs covered with the bacilli, and its tail flicking infection to the milk-pail. Neither of those animals could be touched; the wretched things were allowed to remain there, the half-hearted Order providing for the removal of the cow with the affected udder only. As to improving the conditions generally, the landlord would not, and the tenant could not. The tenant said: "Why should you come upon me for these things; you take meat and milk from abroad, and you do not know anything about it, not even where it comes from." There was a good deal of reason in that too. It seemed only fair, that if our farmers were to be compelled to produce good milk and meat, that similar articles should not be accepted from abroad without any thorough inspection being placed upon them.

The President (Mr. C. Drabble) said that regarding the question of price to be paid for milk produced under improved sanitary conditions, he knew of a case in point where a man who had about sixty milk cows had taken the precaution to have the whole of them inoculated for tuberculosis. His sanitary arrangements were also excellent; in fact, they were about perfect. This man got 16d. a gallon for his milk, and he did not think he had any difficulty in getting the price. He thought that if people would only take the trouble to think there would not be any difficulty experienced in obtaining an enhanced price for good milk. There was no doubt about it that the state of some of the cans in which the milk was sent from the country districts into the towns made pure milk impossible. He had seen milk cans disgustingly dirty. He thought it would be a good idea if the railway companies would provide proper cans and conveyances for milk traffic. The milk in Bradford was not good; it came from the country districts in traps, and was shaken up by the furious driving to such an extent, that by the morning following the night of its delivery it was sour. Dirty cans were also a factor to be reckoned with.

Mr. J. W. Brittlebank (Manchester) suggested that before they started a campaign of improvement they should first know what it was they wanted. A very large number of people, sometimes even including the administrative officers, did not know what they really wanted. The subject under discussion was one which ought to be standardised in some way, as for instance, it should be laid down what constituted a good cowshed as distinct from a bad one. He thought that municipal authorities certainly should encourage town cowkeepers. He thought that as regarded the price paid for milk one should be able to expect very much more than was usually obtained at present. When one paid 4d. per quart, for instance, one ought to be supplied with an article quite free from all filth and contamination. In some of the lower parts of the cities and towns one could get milk even as low as 2½d. a quart, which was certainly not enough in his opinion. But at 4d. per quart milk should be supplied which had been produced under all the conditions which ought to be laid down with a view to ensuring its purity. He quite agreed that people were prepared to pay more for a good article than they did at present. As to the recommendations to educate the young he agreed with the suggestion. In Manchester the authorities were doing all they could to educate children in the schools, especially with regard to the treatment of infants, preparing the girls to some extent for their duties in later life. They were, at any rate, being taught the rudiments of a sanitary science. He agreed with Mr. Butters that the town cowkeeper should be encouraged, but only if he was cleanly and observed the regulations; if not, he should be promptly dealt with.

THE DISPOSAL OF DEAD ANIMALS FROM A SANITARY POINT OF VIEW.

By Wm. F. SHAW, F.R.C.V.S.

THIS is a subject which sooner or later must occupy the attention of all sanitary authorities. I do not propose to give a lengthy paper on the various ways of disposing of dead animals, but I wish to lay before you a few facts which may form the basis of a discussion and perhaps help to rouse sanitary authorities to the importance of this subject.

In my opinion all knackeries or places used for the disposal of dead animals should be municipalised, but so long as there is a commercial value on the carcases of large animals, such as horses and cattle, I doubt if the municipal authorities will trouble much about the matter. It is an unpleasant and disagreeable subject, which some people may think is best left alone whilst knackers will continue to do the work. The sanitary authorities license and issue regulations as to the manner in which knackers' yards should be conducted, and inspectors occasionally visit the premises to see that some of the regulations are carried out; but if the matter is looked at from a strictly sanitary point of view, does any person present know where there is a single knacker's yard which is up-to-date as regards the sanitary arrangements of the premises? I do not know of one which is conducted without causing more or less of a nuisance to the immediate neighbourhood. I rather suspect the reason why these premises have been allowed to exist in their present condition is not because some of them carry on business under an old Act of Parliament of George III., but because, should the sanitary authorities place proper restrictions on such premises and see that the regulations are strictly carried out, it would compel the owners to pull down all the old buildings, of which most are composed, and either establish them away from inhabited houses or rebuild them in an up-to-date sanitary condition on the present sites. The capital required for such extensive improvements could not be found by the proprietors of knackers' yards, or if found no interest could be paid on it, for there is not the slightest doubt that the knackering trade

in large towns, and even country districts, is a declining one. When a question of public health is at stake there ought to be no reason why the municipal authorities could not buy up or compensate the present owners and do this work themselves in a proper manner, either at a profit or even at a loss.

Should the authorities compel the owners of the present knackers' yards to make such structural improvements, and adopt measures by which these premises could be maintained in a sanitary condition, and if the proprietors found that it would be too costly, or that it would not pay them to do so from a commercial point of view, there is at present no reason why the owners could not close their gates and refuse to do business. In a city like London, for instance, where seven of the knackers' yards are owned by one company, who weekly dispose of the carcases of about 500 animals, the sanitary authorities would find themselves in a very awkward position if this should take place, and during a hot summer the effect would be very serious, as neither the authorities nor the owners of animals could compel a private firm to resume work if it were disposed not to do so, and the firm could stop the work for an indefinite time, or until they compelled the authorities to remove the restrictions, as no provision has ever been made for this contingency.

The danger to public health of a large number of carcases undergoing putrefaction in a city can be readily understood, more especially as in some carcases, such as horses which may have died from twisted intestines, gangrene of the lungs, blood poisoning, or animals which have been exposed to fire, putrefaction will take place in a few hours if they are not disembowelled very shortly after death. It is now time that all sanitary authorities should recognise this fact, and prepare themselves for such an event. This could be done in either of the three following different ways: Firstly, by purchasing the existing knackers' yards and reconstructing them; then, when this work has been properly done, they could either be leased to persons who were prepared to carry on the trade under such restrictions as the authorities might impose, or the authorities could work the premises themselves. Secondly, by building fresh premises and undertaking this work in opposition to the existing knacker's yard; this would perhaps be very difficult, as serious objection would be raised by the owners of any land or premises adjoining that which might be selected as the sites. Thirdly, by granting licences for the construction of carcase-receiving depôts, which would be practically horse and cattle mortuaries. In these depôts dead animals could be received and disembowelled; the carcases could then be removed to more convenient premises for

cutting up, boiling, and for the manufacturing processes on the materials derived from such carcases.

Carcases of horses and cattle have depreciated in value during the last twenty years at least fifty per cent., and it is possible that in the next twenty years these carcases may have no commercial value whatever, except as regards the hides. It must not be thought that persons who carry on knackers' businesses have made large fortunes during the last twenty years because they have purchased the carcases at half the cost of what was paid in former times, for as the carcases have depreciated in value, so have the saleable materials obtained from them also depreciated quite fifty per cent., such as meat, hides, oil, fat, blood, bones, hair and horn. Meat used as cat and dogs' meat was once sold in large towns such as London at £1 per cwt., and I have seen a receipt where as much as 23s. had been paid per cwt. for meat by cats' meat vendors; it can now be purchased at from 10s. to 14s. per cwt. The demand for meat has fallen off, biscuits and meal for dogs' food have become popular; this kind of food is cheaper, more cleanly, and it does not necessitate getting a fresh supply every day. The demand for this class of food is clearly shown by the number of prosperous biscuit factories for the most part exclusively engaged in the manufacture of biscuit and meals for dog feeding. Cats are not fed on horseflesh so much as formerly, as here again times have changed, since the introduction of frozen meat for human consumption. Twenty years ago a family would have to pay 10d. or 1s. per pound for legs of mutton in good condition, but now people can if they wish purchase perfectly sound legs of mutton from sheep in prime condition at frozen meat stores at 4½d. per pound; and it is only reasonable to suppose that the householders who could not afford to feed their cats on meat at 1s. per pound do not object now to giving their cat trimmings of a joint costing less than half the price. The demand for meat as dogs' and cats' meat in large towns not being so great, it has reacted also on the country districts, which formerly used to send their meat to these centres, so that now it cannot be sent for any long distance as it would not pay on account of the carriage.

A few years ago the price of worn out and lame horses ruled high, partly on account of the demand for meat for dogs and cats, and partly because the meat of lame and worn out horses was sent in a salted condition to the continent for human food; but the prohibition of this class of imported meat to the continent has decreased the value of the carcases of such animals by one half. At the present time only live horses in a condition fit to travel and be shipped are exported to meet the demand, but at

any time an order might be made prohibiting the importation of horses for human food on the continent, and as 8,000 are shipped from the Port of London yearly, it would cause these horses to be destroyed in some manner in England. At the present time there is no demand for horse-flesh in this country for food for human beings, therefore the carcases of these horses would have to be dealt with at the knackers' yards. The number of carcases of animals passing through knackers' yards throughout England must be considerable, for in London alone, where most of the knackers' yards are under one company, they deal with the carcases of about 28,000 horses and cattle during the year, besides a number of smaller animals, such as sheep, goats, and pigs.

Hides are worth considerably less than they were years ago owing to large importations from the colonies and foreign countries. Oil and fat, which were once very valuable articles, have depreciated in value owing to the vegetable and mineral oils which have been substituted for animal oil: this oil which was sold as high as £40 per ton can now be purchased at about £23, and it has even been as low as £17. Blood is not worth a third of what it was; formerly it was used considerably by certain trades such as dyers, etc., but other materials have been substituted, and now it is chiefly used for artificial manure. Bones have fallen in value from £6 or £7 per ton to about 50s. Hair and horn are lower in value. If carcases in a sound condition are worth very little and are gradually becoming worth less, what value can be put on the carcases of horses and cattle in a putrid or semi-putrid state? They are at the present time worth nothing.

The removal of carcases after death is another question which needs great consideration, and it should be illegal for any horse owner or cattle owner to keep the carcase of an animal which has died on his premises longer than is absolutely necessary for its removal. It is this speedy removal which is most necessary to keep knackers' yards free from stenches. Any owner who deliberately or through carelessness allows a carcase to remain in a hot stable or cowshed for perhaps hours and sometimes a day or two days should be subject to a heavy penalty, for animals to be kept for hours without being disembowelled causes putrefaction to set in and the carcases become what is known in the trade as "stinkers"; such carcases should be destroyed and it should be illegal to boil them.

When a horse or cattle owner outside a town finds his dead animal to be worthless except for the hide he has the carcase skinned and sometimes causes it to be buried. If it is not right to bury a human body without having the death registered, and being buried in a spot approved by the

sanitary authorities, it surely cannot be correct to allow a person to bury the carcase of an animal, perhaps in a putrid condition, anywhere he may please on ground he may rent or own.

The death of all animals should be registered and notice should be given to the sanitary authorities as to the disposal of the carcase, and any person found burying an animal without the sanction of the sanitary authorities should be liable for the offence, for who can say if the owner has not buried the carcase without disembowelment near a water-course or well which may supply persons with drinking water? And may not many of the obscure outbreaks of enteric fever in rural districts, which have puzzled medical officers of health from time to time, be attributed to this source if the true facts could only be ascertained?

I think it is also reasonable to suppose that the alarming increase of tuberculosis in pigs during the last few years is in a great measure due to the objectionable practice of some owners of cattle, allowing carcases of animals affected with tuberculosis, after they have been skinned, to lie for weeks on or by the side of manure heaps with pigs at liberty to feed on them. Some owners also slaughter cattle, which may be too badly diseased to send to market, and give the flesh in a raw or partly cooked state to pigs as a food, no matter with what disease it may be affected. Cattle badly affected with tuberculosis now being worthless, either for human food or even at the knackers, I think the practice of pig feeding with such carcases has increased. These animals will not now be received at the kennels, where formerly they had a ready sale, for biscuits and meals have taken their place. The registration by the sanitary departments of all diseased carcases disposed of, or animals slaughtered affected with disease, will for very shame stop much of this objectionable manner of pig feeding. The owners of pigs would themselves benefit as the price of pork, which has for some time past been low, would increase when the general public were certain that tuberculosis in pigs was not such a prevalent disease as now.

The mode of conveying dead animals on an open knacker's cart is a disgrace to this country. What is a more repulsive sight to a sensitive person or timid child than to see a dead horse or cow exposed in an open cart, with often blood running from the head or nostrils and sometimes even the intestines protruding from the carcase. All dead animals should be conveyed in a properly-constructed and enclosed vehicle, passed and approved by the sanitary authorities.

In large towns and cities it is not an uncommon thing for a person, having a dog die, and wishing to save the expense of destruction of the

carcase, to either bury it in his own garden, back yard, or deposit it at night in a bye street, or public square. As dogs vary in size from a large St. Bernard to a toy terrier, can it be right or healthy for an animal, perhaps nearly as large as a donkey, to be buried in a suburban or town garden, usually without being disembowelled? I maintain this condition of things should be stopped, and every Borough Council should have a destructor, where such animals might be brought by the owners and destroyed, free of cost, or at a small charge. With reference to the carcases of the smaller animals, such as dogs, cats, etc., which are frequently seen lying about the public streets and bye-ways for days and often weeks, I would suggest that it be one of the duties of the police to notify the sanitary department, whose work it is to keep the roads clean, and such department, on receiving notice from the police, should at once have the carcase removed and destroyed. The authorities have always their remedy against any person who may be found depositing a dead animal in the highway, or even on vacant ground, and if the duty of notification should be placed on the police, the sanitary department can have no excuse whatever for allowing a dead animal to remain and undergo putrefaction exposed to public view.

Mr. W. Perryman (London) said the facts as stated by Mr. Shaw respecting the disposal of carcases in London could not be disputed. Coming from London as he did he had seen a good deal of the knacker business, but it had never previously occurred to him to consider the awful predicament they would be in if the people engaged in such business were to go on strike. There was practically no provision made by the authorities for dealing with the carcases if the present company so engaged refused to take them away. As the private company (Messrs. Harrison and Barber) had practically a monopoly of the trade he thought a suggestion should be made that the sanitary authorities should be in such a position to cope with the matter should occasion arise. He would not suggest opposition, because he believed that private firms such as those could carry out their work much more satisfactorily than could the municipality. In country places the burial of carcases was very important. There was no doubt that they were often buried close to water-courses, and that consequently the streams frequently become contaminated. If carcases were to be permitted to be buried at all, he would have some regulations made as to the depth at which they should be put. The borough council should be compelled to take some steps, especially with regard to the disposal of the carcases of dogs. At many of the destructors in London, belonging as many do to private firms, the carcases of dead animals were refused. There should be some power obtained whereby they

could be sent to a destructor used for borough refuse, a nominal fee to be charged, and thus do away with the objectionable practice so often adopted, of burying small animals in gardens, close to houses and at a very shallow depth.

Dr. Thomas Savage (Warwick) said that if buried at a less depth than four feet the carcases of animals were a constant source of danger on account of the action of earth worms. The ideal method of disposing of dead animals was destruction by burning. The Board of Agriculture had issued an order authorising licenses to be given for the burning of animals dying from anthrax. The Warwickshire County Council, at their last meeting, decided to issue an order making it compulsory that any animal dying from that disease in the county should be burned, and the cost should be met by the county. The Board of Agriculture in their order stated that about one ton of wood, fifteen hundredweight of coal and two trusses of straw were sufficient material for the complete combustion of a beast dying from anthrax. The Northampton County Council had invented an apparatus which was rather costly, the combustible materials coming to something like £6. Of course, there was a difficulty with regard to burning in the case of animals dying from anthrax. It might sometimes be better to bury them on the spot and not remove them at all. Perhaps some member would make a suggestion as to facilities for causing the combustion of animals to be less difficult of accomplishment and also less expensive than at present.

Mr. James Rowe (London) said that he was not aware that the value of dead animals had depreciated to such an extent as was stated in the paper. As an instance, he believed that four years ago leather advanced in price very materially, and that now one had to pay something like 4d. a pound more for it. Regarding the burial of animals, he had seen a great deal of it in country places, and especially during the cattle plague. He knew of more than one place where cattle which had died of disease had been buried close to a bowling green. Carcases were often buried near water-courses also. There appeared to have been in the past a disposition to choose a cemetery for human beings on account of its position with a view to beauty, often with a river or other water-course running near. With reference to the kind of foods which pigs were allowed to feed upon, he knew a farm on which everything was as perfect as anyone could wish to see, except in that one respect. He had seen pigs struggling over the viscera of cattle, and had got himself into trouble for expressing his opinion on the matter. Regarding the burial of dogs found in the streets, he used to get a great many of his little dogs cremated, but a great many others were buried. He had not known of any harm being done by the burial. If one had to pay 5s. or 6s. to have a dog disposed of by burning, it was a rather serious

item. Besides, if cremation were made compulsory, he saw possibilities of carcases of dogs being thrown over into his yard for him to dispose of.

Mr. Garnett (Windermere) said that his experience of the burning of the carcases of animals was that it came out at a cost of about £2 per head. In the burning of cattle and horses they ought to insist that there should be plenty of draught underneath the carcase. Coal should not be used; coke and old railway sleepers made a very good fire, from a ton to twenty-five hundredweight of the former being used. Burial of carcases, he thought, had so far been fairly satisfactory when properly performed. A friend of his who had recently returned from India had told him of an incident which went to show that there was not much danger as a rule attendant upon this method of disposing of the carcases of animals. The party to which this friend was attached had the misfortune to lose an elephant. The carcase was very deeply buried, and, as the natives would insist upon eating the flesh, a guard was set over the place of burial for at least a week. But on the first day the guard was withdrawn the natives dug up the animal and devoured practically the whole of it. So far as could be ascertained none of the natives who partook of the elephant suffered any ill effects. Such experience suggested that, if there were no disease germs in the animal, there would be little ill-effects as the result of burial. He thought that in the selection of a site for the burial of animals which had died from any infectious disease the position was a very important one. Provided the external orifices were properly plugged up, and the animal was stitched up in canvas, he thought it was perfectly safe to remove any carcase from any situation to a suitable burial ground. Distance should be no object. The chief object should be to get the animal buried as far away from any water-course as was possible. On the previous day he had seen a case in which an animal died from anthrax in a water-course, and had been allowed to remain there for over twenty-four hours. It would usually be found that farmers selected the softest and most boggy land for the disposal of their animal carcases, whereas, of course, they should, as sanitarians, insist upon the driest possible land being used for the purpose.

Mr. J. B. Wolstenholme (Manchester) said it appeared to him that the idea of the paper was not so much to deal particularly with the disposal of the carcases of animals which had died from some disease, as to deal generally with the disposal of dead animals. The paper seemed to have been written to raise the question whether or not it was possible that places where carcases were disposed of should be municipalised, and whether, if they were not municipalised, the proprietors of horse-slaughtering yards should be compelled to put themselves more in line with ordinary sanitary conditions. No man knew better than the veterinary surgeon the abominable conditions of the majority of the places to which dead animals were taken. He did not think it was the veterinary

surgeon's duty to look after the sanitation of a place like that. It should not be left for the observance of ordinary general sanitary conditions to fall within the purview of a veterinary surgeon. The vast majority of the slaughtering establishments in this country were a crying scandal and a menace to the health of the people in the neighbourhood. One could often scent them at a long distance, and there could be no doubt as to their foulness, but it was a question more for the sanitary officer than for the veterinary surgeon. He was surprised to learn from one of the speakers of the primitive state in which some such matters in London still seemed to be. If he might judge from what he heard, it seemed that London had still a great deal of reform work before it if it wanted to get into line with the big cities in the North of England, where it was not difficult to send their small animals when dead to the municipal destructors. In some of the towns there were furnaces that would burn anything, and the animal was disposed of in the most sanitary manner possible without any charge being made. If London had not yet adopted such a method it was high time that it did so. Respecting the method of disposing of carcases by burial he had come to regard Highgate Cemetery as one of the standing examples of the great power that there was in the soil of reducing animal bodies to their more elementary constituent parts. At Highgate this process was carried out completely, and he had never understood that water from the fountain there caused ill health, and he had always looked upon it as an object lesson of the great reductive power of the earth. Mr. Wolstenholme added that he was afraid that the traffic in horse-flesh for human consumption had not yet ceased. There was something very repulsive to his mind in the way in which the flesh of horses was gathered up in pest-houses, salted and sent abroad for human beings to eat. If the countries to which this flesh was exported did not prohibit it from entering their ports, he, for his part, wished that his own country would prohibit the exportation of anything dressed and salted under such conditions. He thought that domestic animals should not be allowed to be kept in connection with a knacker's establishment. He found from experience that both poultry and pigs kept about such establishments became tuberculous in a very short time.

Mr. Hickes (Market Weighton) spoke of the expense incurred in burying, and said that a dead horse was now of very little value. It was a very difficult matter for some farmers to get a knacker at all. As to the disposal of animals by any means it must always be in the country largely a question of cost. If it were cheaper to burn he would advocate burning, but if it were cheaper to bury he would recommend burial. The cost of burying of course differed in various places. On the Yorkshire Wolds to dig about twelve feet through the chalk necessitated three or four men working a whole day. There was no fear of contamination when the carcase was properly buried. In ten years' experience as Veterinary Inspector he had never known a case of anthrax

occurring through the burial of a diseased carcase, when this burial had been carried out in accordance with the anthrax order.

Mr. J. S. Lloyd (Sheffield) described the cremation of a beast which he had recently witnessed. A hole had been dug in the ground somewhat in the shape of a cross, and soil had been heaped round it and iron bars placed across the top. The idea of that arrangement was to get a good current of air passing underneath. No matter what the direction of the wind was it was bound to pass underneath by way of one of these channels. He mentioned that in Sheffield the Cleansing Department undertook to collect the carcases of animals, and dispose of them for a uniform cost of about 2s. 6d. In the case of dogs and cats, if called for by the ordinary dust cart it meant only a tip to the dustman.

CONGRESS AT BRADFORD.

CONFERENCE OF SANITARY INSPECTORS.

BAKEHOUSE REFORM.

By F. J. ROWE.

ABSTRACT.

DEALING with the impending crisis, the inspector set forth the arguments for and against cellar bakehouses, making out a strong case for their abolition, based on their generally dilapidated condition and the difficulty of securing adequate daylight and ventilation, following this up with a brief review of the statutes affecting the question, and showing how, stage by stage, the legal net had been drawn tighter and tighter round the baker and his operations in the public interest, and more especially for the benefit of the workpeople.

Leading up to the Factory and Workshop Act, 1901, the writer characterised this as a drastic measure round which the battle of the bakehouses was about to rage more or less furiously.

The main provisions of this Act were next considered, particularly with respect to the structural conditions required to qualify for the certificate of the Sanitary Authority.

The appeal from the council to the Court of Summary Jurisdiction in case of refused certificates, met with adverse criticism, the author contending that the court as ordinarily constituted was not calculated to inspire confidence, because neither the lay nor the legal mind were necessarily conversant with the merits of the details which would form the crux

NOTE.—The Proceedings of the Conference commenced with an Address by ISAAC YOUNG (*see page* 209).

of each case, and such knowledge could not be acquired in five minutes. He submitted that any decision given against the authority would not only weaken their hands, but would unavoidably lower the standard of suitability which it was to the public interest to maintain.

The absolute and permanent nature of the certificate provided a text for speculation as to whether the legislature had well considered the probable effects of such perpetuity. Had it been provided that certificates should be granted subject to conditions of continued suitability, and renewed at intervals, the underground bakehouses could have been closed a few at a time each year, then the shock with its consequent irritation would have been reduced to a minimum.

The set of standards promulgated by the Association of Medical Officers of Health was next considered, the conclusion being drawn that, speaking generally, the cellar bakehouses did not lend themselves to the conditions enumerated, because they did not sufficiently resemble each other, either in outline or detail, to make the application of uniform standards practicable. Some eminent authorities had held that standardising in this matter was a mistake, and who should decide when doctors disagreed?

The business-like attitude of the bakers in face of the emergency was the subject of favourable comment; they had formed associations, obtained the services of architectural and legal experts to protect their interests, and, generally speaking, taken such steps as would lead to prompt and definite issue between themselves and the authorities.

The "Home Office" conference he considered another hopeful sign. Delegates representing the conflicting interests had met in a friendly way, and discussed the medical officer's circular point by point—modifications had been suggested, and the disposition shown to relax hard and fast lines—all tended towards a working compromise.

Considerable difficulty would be experienced to strike an equitable line among the underground bakehouses, to decide which should be abolished and which retained. A few of the best and a few of the worst cases might be easily singled out, but this did not carry one very far, because the major proportion did not belong to either of these classes, and it would pass the wit of man to make such a classification of them as would be likely to give satisfaction all round.

Then followed a personal grumble from an individual baker, who expressed his views on the situation with considerable freedom. He was no believer in the necessity for sweeping changes, and moreover, was of

opinion that very few bakehouses would eventually be closed, and also that each case should be decided on its merits without reference to arbitrary standards.

The paper closed with a suggestion of a Committee of the District Council as providing the most suitable machinery for dealing with the crisis. A committee with its composition reflecting as usual so many stages of thought and shades of opinion would be the best guarantee that every case would be thoroughly inquired into, the best safeguard that no point would be missed or consideration left out, and that humanly speaking, no hasty or unfair or premature decisions would be made.

ADULTERATION: ANCIENT & MODERN.

By F. W. RICHARDSON, F.I.C., &c.,

City Analyst for Bradford and Borough Analyst for Dewsbury.

SOME 2500 years ago, Jeremiah is said to have declared that "The heart is deceitful above all things and desperately wicked," and I would venture to surmise that the prophet had made no very new or remarkable discovery. Deceitfulness, wickedness and adulteration have certainly been bedfellows from the most remote antiquity.

The partial substitution of inferior and cheaper for superior and dearer commodities naturally appealed to the selfish instinct so characteristic of our species. Fortunately the greed for gain often over-stepped itself, and the adulteration perpetrated became so obvious that great public outcries were made and the State or Government found it necessary to interfere.

Over 2000 years ago the Greeks, at Athens, employed a special inspector to discover and stop wine adulteration, and several ancient Roman and Greek writers refer to the sophistication of food, drugs and pigments, and mention rough methods, mostly physical, for the detection of the impurities.

The "staff of life" was much subjected to adulteration, and in spite of the very heavy fines, the pillory, the ducking stool, and even exile, the race of fraudulent bakers was not entirely repressed, and inferior flour, mixed with alum and mineral matters, were worked up into some sort of bread.

About twenty-three years ago I was present in Court to see one who I hope was the last of the fraudulent millers. This man was absolutely blind and yet worked in the mill as if he had perfect sight. He was fined £20 and costs for adding alum to his flour and though he pleaded that he was innocent, he was known to possess alum in quantity, with special machinery for grinding it.

Although I have analysed many samples of flour and bread since the

conviction of this offender, I have never found a single sample to contain alum or any mineral impurity.

Beer gave the authorities a great amount of trouble, and in Europe generally, even as early as the 13th and 14th centuries, special judges and tasters were appointed to examine the brewing materials used and the products obtained.

According to an authority quoted by Dr. Blyth, a necessary piece of apparatus for a beer examiner was a pair of leather breeches.

Some of the beer was spilt on a wooden seat, and the wearer of the breeches would sit down and wait for the sticky character of the malt liquor to declare itself, and its admixture with sugar at the same time. We have in mind a number of men who would regard those bygones times as "good" when, had they lived, they could have become *ale-tasters* bidden, as the oath ran, "to at *all times* try, taste and assize the beer and ale to be put to sale."

It never occurred to anyone until a few years ago to test malt liquors for arsenic, and there can be no doubt that although glucose or starch-sugar was unknown to the ancients, yet their beer must have contained arsenic in quantities sufficient to meet with our latter day disapproval.

The fuel was, no doubt, often arsenical and its fumes fell, as now in this country, directly upon the malt in the kilns.

The analytical Text Books of 25 years ago were few in number, but such as treated of malt liquors, always advised one to search for cocculus indicus, picric acid, grains of Paradise, morphia (from opium) and even strychnine; this deadly alkaloid being added, so it was suggested, to give a bitter taste.

I must confess that I always faithfully carried out the tests for these deadly drugs, and invariably felt relieved when I failed to obtain the peculiar purple colour which in the test would have indicated the presence of strychnine. Gradually the thought dawned upon me that any brewer, or publican, who went out of his way to add such costly drugs to his liquors, for the purpose of killing off the clients he should have wished to live to a ripe old age, must have been absolutely insane. Surely, also, the addition of narcotics to beer would have rendered it unnecessary to drink so much of the beverage to enable the drinker to get "forarder," and less trade would have been done. Possibly in very low quarters in big cities, publicans may have been found to meet a demand on the part of some of their degraded clients, who wished to get drunk at a small expense.

Wine seems to have always lent itself to the art of the adulterator. Fermented decoction of raisins, drugs and vegetable colouring matters

were the principal stock-in-trade of those who were desirous of making one grape go as far as six.

As science has developed, so has the scientific character of adulteration, and to-day, if the wine-maker is only allowed the marc left after grape-juice extraction, some corn-spirit, logwood and brazil-wood, and some small amounts of certain ethers, he can produce marvellous results, as was seen lately in regard to the once famous Niersteiner wine. In this country most wines—particularly ports and sherries—are fortified with corn spirit: this dawned upon me years ago when, as a result of the fermentation of strongest grape-juice I could obtain, I only obtained some 15 per cent. of alcohol, whereas 20 and even 25 per cent. may often be found in port.

It is recorded that in Germany in the fifth century an adulterator of wine was compelled to drink 6 quarts of his own brand. The man died as a direct result of the huge potion; but I surmise that the alcohol alone—which would amount to at least $1\frac{1}{4}$ pints of the absolute article—would suffice to kill him.

It is said that a number of years ago in Cette, in France, the trade did not hesitate to fasten boards with the legend:—"Wines *manufactured* here."

In the olden times litharge, *i.e.*, oxide of lead—was added to wines to give a sweet taste. Dr. Warren told how 32 persons were made dangerously ill, while one died and another became a paralytic through drinking wine containing lead.

Amongst spirits, gin at one time had a very evil reputation for the character of the substances added to it to give certain peculiar flavours:—cayenne pepper, grains of paradise, and even oil of vitriol are said to have been used.

In my experience of 25 years I have never found a gin to contain any other adulterant than water.

The year 1851 is memorable in connection with adulteration, as in this year Dr. Hassall under the auspices of the *Lancet* began his researches into the subject, and by the end of 1854 had made 2,387 analyses. A very large proportion of the samples was sophisticated.

At the commencement of its task—which has conferred incalculable benefits upon the people of this country—the *Lancet* boldly threatened to pillory adulterators by publishing their names in its columns. The threat was carried out—with most beneficial results.

Perhaps no other article showed so much adulteration as confectionery. For colouring matters arsenite of copper, or Scheele's green, chromate of lead, white lead and carbonate of copper were used, and plaster of Paris was used as a make-weight.

About a third of a century ago our City (then merely Town) of Bradford, was startled by the discovery that some 200 people had been poisoned by eating peppermint lozenges, bought in our market.

The manufacturer set out with the amiable intention of adding plaster of Paris to the sweet paste, but the druggist's apprentice by mistake got to the cask of white arsenic.

As each of the lozenges contained two or three grains of this deadly poison it was remarkable that only some 20 out of the 200 victims did not recover.

What a change has come over the spirit of our dreams since this time! Cheap sugars and the Food and Drugs' Acts have completely destroyed the adulteration of sweets. Even sweets at 3½d. per pound consist of pure sugar with minute amounts of harmless dyes; sufficiently powerful to give deep colors for the most minute quantities of substance.

The state of things before 1850 well warranted Tennyson's lines, somewhat atrabiliar, people have thought:—

> "Peace in her vineyard—yes! but a company forges the wine.
> And the vitriol madness flushes up in the ruffian's head,
> Till the filthy by-lane rings to the yell of the trampled wife,
> And chalk and alum and plaster are sold to the poor for bread,
> And the spirit of murder works in the very means of life. . . .
> While another is cheating the sick of a few last gasps, as he sits,
> To pestle a poisoned poison behind his crimson lights."

I have my doubts as to what sort of vitriol the poet refers to; I don't know of any vitriol which would "flush up" into a man's head.

The reference to "chalk" may be an echo of the utterly fallacious, but very popular, idea that the milkman brings back the lost whiteness, due to his aqueous additions, by using cream of chalk.

As any chalk would soon reveal its presence by forming a sediment, no intelligent milk-dealer would perpetrate so discoverable a fraud. The chalk-myth was engendered at the same time as the sand in sugar delusion; a teaspoonful of sand in a pound of soft sugar would readily reveal its presence by its insolubility and grittiness to even a most unintelligent housewife.

The remark about alum was true enough—Dr. Normandy declared he had found from 250–500 grains of alum in a 4lb. loaf.

Of course such an adulteration would most seriously affect the digestibility of the bread containing it.

Plaster of Paris was a common ingredient of sweets, but was rarely ever found in bread; to which if present even in small proportion it would have given palpably undesirable qualities.

Butter used to be let down heavily with water and salt, and it was occasionally mixed with animal fats. When science took butter in hand Oleomargarine was the fruit, and we all know that large amounts of margarine are sold every day under the title of butter.

From my reports Bradford would seem to have a very undesirable record in this direction, but we must remember that *suspected* samples supplied by itinerant vendors, "here to-day and gone to-morrow," make the case seem as bad as it is.

This is our record since 1898 :—

	Butters Analysed.	Found Adulterated.	Per cent. Adulterated.
1898	27 ...	None ...	Nil.
1899	56 ...	16 ...	$28\frac{1}{2}$
1900	52 ...	10 ...	$19\frac{1}{4}$
1901	54 ...	15 ...	$27\frac{3}{4}$
1902	54 ...	18 ...	$33\frac{1}{3}$

The pump or the water-tap was certainly the milkman's best friend in the first half of the last century, and twenty-five years ago a very large proportion of milks were skimmed or watered, or both. Now I rarely meet with an adulterated milk; and last year (1902), out of 108 samples, only one was sophisticated.

Bradford holds a unique position in regard to the high quality and purity of its milk supply.

Throughout the country the percentage of adulteration amounts to 11·2 per cent., while in our City in

1899, out of 172 samples, 5 or 3 per cent. were under the standard.

1900 „ 173 „ 8 „ $4\frac{3}{5}$ „ „ „ „

1901 „ 187 „ 4 „ $2\frac{1}{7}$ „ „ „ „

1902 „ 108 „ 1 „ $\frac{9}{10}$ „ „ „ „

There has, therefore, been a considerable decrease in milk adulteration every year since 1900.

In the ancient times drugs were very fearful and wonderful preparations. In the seventeenth and preceding centuries a doctor's diary became a kind of mortuary record, and the wonder is not that people who fell into the old-time medical man's hands *died*, but that anyone ever recovered under the treatment.

I have before me a quaint little book, of date 1669—just three years after a glorious fire did so much splendid sanitary work in London—and in this "Marrow of Chemical Physic" are receipts for making such weird liquids as the "spirit and oil of a human skull," also "spirit of man's urine" and "oil of bricks."

If many of the older medicaments had been "let down" with water, it would have been to the advantage of the patients, or rather victims, whose constitutions were sorely tried by them.

No pharmacopœia existed till 1612, when the College of Physicians issued the first guide of the kind; needless to say, the remedies seriously proposed in that age excite our risibility, and even horror, to-day.

In 1540 power was given to four censors, all medical men, to supervise the drugs sold at the grocers. (Strange to say, of late years we have been harking back to that old combination of pharmacy and grocery.)

In 1617 the profession of apothecary made itself more respectable by dissociating itself from the grocery trade.

The large amount of inferior articles supplied by the grocers to the apothecaries led to serious disputes, and no doubt paved the way for the officialising of drugs and the production of a series of pharmacopœias.

It was not till 1860 that the first Adulteration Act was formulated. This Act and that of 1872 were faulty in construction, and it was not till 1875 and 1879 that the Sale of Food and Drugs Act took the chief shape known to us to-day.

The work done under these Acts has enormously cut down adulteration, and I think we have every reason to congratulate ourselves on the greatly-improved quality of such articles of consumption as once were liable to sophistication.

Out of over 1100 samples of bread and flour examined in this country in 1901, only 6 were reported against. In this year 1 in every 9 of the milks and 1 in every 10 of the butters was adulterated, and it is to be deplored that tampering with the purity of such a vital fluid as milk has not met with far heavier penalties.

The small fines inflicted are responsible for the stationary condition of milk adulteration, which has remained very much the same for the last decade.

Although it has been my lot to report against rather a large proportion of drugs during the past few years, the amounts of adulteration have been small and it has rarely been necessary to resort to a prosecution.

Taken as a whole, we have every reason to be satisfied with the comparative purity and strength of the drugs supplied to the public, and, were adequate punishment meted out to the adulterators of milk and butter, our general food supply would be of such an improved character that we might be excused for believing in the near approach of the millenium.

SMOKE ABATEMENT.

By WILLIAM NICHOLSON,

Chief Smoke Inspector, Sheffield.

TO attempt to adequately deal with the question of smoke abatement in twenty minutes would be as foolish as to attempt to put out Vesuvius by a baptism of rosewater. I shall try to display a little wisdom by not attempting such an impossible task.

A lady lecturer on the smoke question a few years ago, who, unlike many of her sex, had more decisiveness than discretion, said "that all smoke was an abominable and intolerable nuisance and ought to be done away with." I remarked at the close of the lecture "that smoke could easily be stopped by putting out the fires, but the remedy would be a thousand times worse than the disease."

Smoke is unquestionably not only a local but a national nuisance, and the cost financially, physically, and morally, is beyond compilation. The Public Health Act, 1875, Section 91, and Sub-section 7 says: "Any fireplace or furnace which does not, as far as practicable, consume the smoke arising from the combustible used therein, and which is used for working engines by steam, or in any mill, factory, dyehouse, brewery, bakehouse, or gaswork, or in any manufacturing or trade purpose whatsoever, and: Any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance shall be deemed to be nuisances liable to be dealt with summarily in manner provided by this Act. *Provided* that where a person is summoned before any court in respect of a nuisance arising from a fireplace or furnace which does not consume the smoke arising from the combustible used in such fireplace or furnace, the court shall hold that no nuisance is created

within the meaning of this Act, and dismiss the complaint if it is satisfied that such fireplace or furnace is constructed in such manner as to consume as far as practicable, having regard to the nature of the manufacture or trade, all smoke arising therefrom, and that such fireplace or furnace has been carefully attended to by the person having the charge thereof."

Section 334. "Nothing in this Act shall be construed to extend to mines of different descriptions, so as to interfere with or to obstruct the efficient working of the same; nor to the smelting of ores and minerals, nor to the calcining, puddling, and rolling of iron and other metals, nor to the conversion of pig iron into wrought iron, so as to obstruct or interfere with any of such processes respectively."

This Section 334 is known as the "*Saving Section*," for certain specified exempted trades, but they are only exempted to the point of practicability, and not allowed to make as much unnecessary smoke as they like, as it is generally believed. Coupling with this Section, *Sub-section 7 of Section 91*, the Local Authorities have power, if they care to use it, to deal with any chimney (except the chimney of a private dwelling) which serves boilers, furnaces, or fireplaces.

Chimneys must be constructed on the most modern principle, carefully and skilfully attended to by the person in charge so as to consume, as far as practicable, the combustibles used therein.

Part of Sub-section 7 says, "*Sending forth black smoke in such a quantity as to be a nuisance.*" It would undoubtedly be advantageous to delete the word *Black:* (1) It would remove qualms of conscience which the Inspector may sometimes have when he books thick Brown preventable smoke for Black. (2) There would be an end of doubt in the minds of magistrates as to whether it was black, confusion and confliction of witnesses as to colour, and *convictions in every case.* (3) Then there would be no escape for the smoke sinners (and there are many of them) who allow their chimneys to belch out continuously dense volumes of smoke, which is not black, but practically preventable, and for which they ought to be punished.

'Tis true that an "ounce of practice is worth a ton of theory," even on the smoke question, so we shall take as our text the sections stated, not swimming in the sea of sentimentalism, but taking for our platform *Practicability*, which is the only aspect of the question likely to prove profitable.

Smoke from Steam Boilers.

A few years ago the belief was universal that the emission of dense volumes of smoke from boilers was absolutely necessary to make steam.

The more smoke the more steam, and to stop smoke would cripple trade and ultimately drive it out of the country.

Thanks to the persistency of the practical engineer the belief has been buried, we hope never to rise again, and to-day it is universally acknowledged that, under normal conditions, there is no necessity for opaque smoke, and the preventing of it is a boon to the public and to the manufacturer by the saving of fuel or generation of more steam, more work done, and trade not hindered but helped. Yet there are towns and cities, not including Sheffield, who ignore these flagrant, favourable facts, and continue to emit from their boiler chimneys dense volumes of smoke.

CHIEF CAUSES.

1. *Shortness of boiler power*, which necessitates the unduly forcing of the fires.

2. *Defective draught*, the result of small flues and a low chimney.

3. *Common dirty coal*, which makes smoke instead of steam.

4. *Senseless stoking:* the stokers putting on the fire *three times as much coal as they ought.* Some do it because they know no better, others through laziness to make it last, and others because they are compelled, having other work to do. There are other causes we have not time to touch upon.

CERTAIN CURES.

1. *Plenty of boiler power.* I know of no better practical economical smoke preventer than this, and manufacturers are well advised when they put in boilers well over the work they will be called upon to do.

2. *High chimneys and big flues.* These produce a good natural draught, and it is unquestionably the best from the point of view of public health and comfort. "Forced or induced draught" may be considered the best from a manufacturer's point of view, as it may be used with a low chimney, cheap coal, or an apology for it, and more work obtained out of the boilers, and a saving effected of sixty or more per cent. Some may have realised all that is claimed for artificial draught: we know many who have not. But we are quite sure that the general public consider smoke emitted at a height of 25 feet a nuisance, and a continual shower of grit when deposited in the eyes is not pleasant.

3. *Fair class of fuel*, which makes less smoke and more steam.

4. *Admission of air to the furnace is absolutely essential.* The quantity can only be decided by the conditions of working, the amount of coal put on the fire, and the nature of the coal. The big question of whether the

air should be hot or cold, admitted at the door, through the bars, at the bridge, or anywhere else, we have not time to touch.

The bigger question of mechanical appliances for doing this work automatically or otherwise must also be passed by, for their name is legion, the variety endless; and my advice to manufacturers is to test them thoroughly, and to adopt the appliance most effective in smoke prevention and economical in working.

5. *Sensible stoking.* A little common sense even in stoking, as in other matters, is very valuable. In my opinion (and experience has proved the truth of it) the most sensible, scientific, and profitable system of firing is "Side firing," feeding one side of the furnace, allowing time for the incandescent fire on the other side to consume the gases before it is fired. The firings must also be light, and frequent, then there will be no preventable smoke emitted, less coal burnt, and more work got out of the boilers.

6. *Skilled stokers.* Good stoking, without question, requires dexterity in practice and expertness in execution, and the sooner the universal idea that any man is suitable for stoking who can use a shovel is exploded, the better, and the nearer we shall be to the solution of the smoke problem.

A stoker must be strong in the arms but not weak in the head. He must be an intelligent man, for to fire furnaces without making volumes of smoke is an art that few recognise. He is also responsible for the water, steam, and in many cases other things almost too numerous to mention which make it a difficulty to fire efficiently.

There are many skilled stokers who take an intelligent interest in their work, receive good wages, and are very profitable servants, but the class, as a whole, are incapable of discharging the onerous duties of stoking, and one cannot wonder at it. They do splendidly considering they have had no special training, and in many cases they are only paid a labourer's wages, which is not a very great inducement for them to increase their knowledge and make themselves skilful workmen. The masters are constantly complaining of the work being badly done, the independency of the stokers, and their fear of discharging them with every prospect of getting worse.

'Tis true the masters have cause for complaint, but they are not free from blame: if they would pay better wages they would get more intelligent men (though lacking the technical training), who would soon acquire the necessary knowledge, and more than make the extra money paid to them by the saving of coal, the life of the boilers, and general repairs.

I wish to strongly emphasise the fact, that with favourable conditions of

working, and with or without special appliances for preventing smoke, the stoker can prevent it, if he is sufficiently expert.

Technical training is absolutely necessary if we are to have in the future skilled stokers who will prevent smoke. There being no facilities for such a training, it is the duty of our Educational Authorities to provide in our day schools and night schools, classes, lectures, and demonstrations, of which great numbers would avail themselves to procure certificates of efficiency and gain higher wages, and not only themselves, but their masters and the public would derive the benefit.

If those whose duty it is will not provide the technical training, then The Sanitary Institute should carry it to a successful issue, as it has done in other branches of sanitary science.

Smoke from Metallurgical Furnaces.

Metallurgical furnaces include all sorts and sizes of reheating, muffle, annealing, and hardening furnaces.

This is bigger than the boiler question, and only a few dare to face it. Nearly everybody says "black smoke must be made; to stop it would spoil the steel and ruin trade." I admit some smoke is necessary in special processes (working very thin steel, annealing, and hardening), but even in these, not to the amount of 20 to 40 minutes in the hour. In the ordinary reheating furnace, if properly constructed and worked under normal conditions, little smoke need be made. *How is it made?* The chimney being 25 feet high instead of 80 feet at least, is responsible for a fair share by insufficiency of draught, and to make up for this steam jets are put into the furnace which, if injudiciously used, make matters worse instead of better. The smoke is made by putting into the furnaces, in many instances, six times more coal than is necessary. This is done to make the firing last, for the men and boys who fire have other work to do, the firing being considered *an extra*, so they don't know or care how much smoke they make, and the doors, which have no provision for air admission, are instantly shut after firing, creating a nuisance beyond description.

Practical prevention is possible in spite of what many manufacturers, metallurgists and others may say to the contrary. It has been in my own experience positively proved that large quantities of unnecessary smoke are made, and to prevent it will not in the slightest degree hinder, but help trade.

But it is almost impossible to convince those interested, and to induce them to make the experiment. It is the duty of Health Authorities to

use the power the Public Health Act, 1875, gives to compel smoke makers to prevent all unnecessary smoke from furnaces.

1. Make them raise the chimney from 25 feet to a reasonable height—80 feet at least—which would not in the slightest degree interfere with any kind of process in the furnace, for the draught could be regulated by dampers, and the only objection is the cost.

2. Owners of furnaces ought to be compelled to have skilled stokers, and not allow anybody and everybody to fire whose knowledge of stoking extends to the knowing of where the coal has to go. Special stokers would quickly revolutionise matters and reduce smoke to a minimum. Heats would be raised quicker, less coal consumed, and the abominable nuisance practically abated.

As a proof I cite one case of a number in my own experience. A chimney served two very large reheating furnaces used for special steel. In working this steel metallurgists said "it was necessary for the ingots to be in an envelope of smoke to prevent decarbonization, and it was absolutely necessary to emit black smoke for twenty and more minutes in the hour, and to emit less would spoil the steel, and ruin trade"; and nearly everybody interested, being predisposed in that direction, believed it. The owner of the furnaces was a reasonable man, and prepared, if practicable, to lessen the smoke, as it was a nuisance to him. The furnaces were worked on the lines suggested for a number of weeks, and the result was more work done by the furnaces, less coal consumed, and the all-day observations of the said chimney were not an average of twenty minutes of black smoke in the hour, but a point under five. This owner would take a lot of persuading to go back to the old system.

Smoke from Dwelling-House Chimneys.

Section 91 of the Public Health Act, and sub-section 7, gives power to proceed against any chimney *not being the chimney of a private dwelling-house. These* prayed to Parliament for exemption, saying "Let *us* alone," and the prayer prevailed. Why they should be let alone, and allowed to do what other furnaces and fireplaces are not allowed to do, is one of those things that it is difficult to understand.

Sir W. B. Richmond, R.A., President of the Coal Smoke Abatement Society, and his courageous colleagues think that these chimneys have been let alone long enough, and are determined to treat them as other chimneys. A Lighting, Heating, and Smoke Abatement Exhibition at the Crystal Palace was opened on December 13th, 1902, for five weeks

and the Association offered a prize of £50 for the best domestic open grate, the one most capable of consuming its own smoke. Exhaustive and most efficient tests were made and the prize was awarded to the best, which ought to be adopted.

The Society has done splendid service in London *re* smoke from boilers. They deserve our hearty co-operation in their crusade against smoke from dwelling-houses, and I trust the day is not far distant when they will commence *a national crusade against smoke from metallurgical furnaces*, as nobody else seems disposed in that direction, which will be rewarded by the much desired reform.

I have attempted briefly, and trust succeeded, in showing that smoke abatement is possible, practical, and profitable. Sheffield has a world-wide reputation for its steel and its smoke. The former it thoroughly deserves, and the latter no doubt it did years ago, but to-day we are proud to proclaim, considering the heavy trades and the amount of coal consumed, that Sheffield, in comparison with other cities and towns with which we are acquainted, is practically smokeless so far as boiler smoke is concerned.

I need not inform you that even Sheffield is not (nor professes to be) perfect on this question, but we claim to be practical. We have a very practical, persevering Medical Officer of Health in Dr. Robertson, and a very practical Health Committee. Manufacturers have spent thousands of pounds on apparatus, useful and useless, to prevent as far as practicable all smoke from boilers, and are willing to spend more if a good appliance comes along, for which they deserve great praise. Also we are hoping to convince and convert them to pursue the same practical policy to prevent smoke from metallurgical furnaces, but if we fail to perform this miracle, then it will be the duty of someone to compel them.

We have also some very practical magistrates, who will not convict if an attempt is being made to end the smoke fiend, so being a practical community we have a *practical policy*.

We proceed under *the Public Health Act*, 1875. Thirteen years ago we commenced to grapple with this question in earnest. Previous to this period the recorded average of black smoke was 10 minutes per boiler chimney per hour, but we very quickly came to the conclusion that the best behaved chimneys had been selected for observation, and not too many of them, for it was no unusual thing for chimneys to emit black smoke for from eight to thirty-eight minutes in the hour.

Chimneys, whether big or little sinners, were observed, the black smoke emitted recorded against them, the works were visited, boilers, apparatus, and conditions of working inspected, and suggestions made for improvement.

The City Council fixed a standard or working limit, which they are allowed.

1 boiler	2	minutes of black smoke in the hour.
2 boilers	3	ditto.
3 „	4	ditto.
4 „ and more	6	ditto.

If these limits are exceeded an abatement notice is served, and if the nuisance is not abated in seven days, or after the time necessary to do the alterations, then other observations are taken, proceedings instituted, an order to abate obtained, and a penalty imposed sometimes. If the abatement order is disobeyed, further proceedings are taken and daily penalties inflicted, from five shillings to five pounds.

In two years from the commencement of the crusade, the average was reduced from ten to two minutes, which is actually more than it appears to be, for three times more chimneys were observed, not only the very best, but the very worst. That improvement has been maintained during the last eleven years.

We strongly contend that this line of practical procedure ought to be taken against *any furnace, fireplace, brick-kiln, or anything else which causes a preventable nuisance.* If the furnaces, apparatus, and system of working are antiquated, then pressure should be put upon the masters to construct furnaces on the best and most modern principle, to adopt smoke preventing appliances that have been thoroughly tested and proved effective, and to work the said furnaces on the best known system for preventing smoke.

It is the work of the sanitary experts to make an attempt to arouse health authorities apathetic on this question to a sense of their duties, by congresses, papers, speeches, books, and by bringing pressure to bear upon them in other ways. To appoint special inspectors, pay them a living wage, which will be an inducement for engineers to leave their trade, and take up this difficult and often distasteful work, for which they are the most capable.

If the attempt fails in the future as in the past, then the Local Government Board should be approached, and requested to appoint, first a few inspectors whose duties are to visit these delinquent authorities, and force them to administer the Smoke Statutes. If this fails (and it will be a miracle if it does not) then it will be our duty to get public opinion on our side by showing that our propaganda is for their profit, to move Parliament, which will move the Local Government Board, and the Board then will move the local authorities, the authorities will move the inspectors,

and the inspectors will very quickly move the smoke makers to mend their ways, or punish them by heavy penalties: then the day will not be far distant when the smoke question will be practically solved. The acres of smoke of which Charles Reade, the novelist, spoke will be a thing of the past; or we might say acres of *dirt*, which Lord Palmerston defined (from the point of view of health) "as matter in the wrong place." Also, as Dr. Robertson says in his "Lecture on the Lungs": "With a purer atmosphere, the lungs (not only of Sheffielders, but of people in other cities and towns), which are as black as coal, might possibly return to their natural pale pink colour, and the enormous death-rate from lung diseases would be greatly reduced."

When that day comes, then the quotation from John Evelyn's "Fumifugium" (a pamphlet he wrote at the command of Charles II.) will not be applicable either to *London or to the Provinces:* "The hellish and dismal cloud of sea coal which is perpetually imminent over this august and opulent city, making it rather resemble the suburbs of Hell than an assembly of rational creatures, and the Imperial seat of our incomparable Monarch."

THE DUAL CONTROL OF HOUSE DRAINS.

IS IT EFFECTUAL?

By W. J. ADDISCOTT,

Sanitary Inspector, Plymouth.

(Associate.)

ABSTRACT.

THE object of the paper is to give those charged with the work of administering municipal jurisprudence the opportunity of discussing the present system of dual control in regard to house drains, and to point out its disadvantages. The paper also shows that there is sufficient work for each department and its officers to carry out, without seeking to take the legitimate work of another department, thereby causing needless friction, to the detriment of efficient administration. The formation in recent years of a Public Health Department in all large towns, with full time officers, naturally causes the public to seek redress for any fancied sanitary wrong from the department bearing that name.

The interest awakened in the public mind, due to the holding of conferences and the spread of sanitary literature, is such that when illness of a serious nature occurs in a family, by reason of defective drains, the question arises, "Who is responsible?" I maintain that one department, and one only, should be responsible, and that the Health Department. Under dual control the Surveyor's Department is responsible until the house is completed or in occupation for the first time. Immediately the house becomes occupied responsibility passes from it to the Health Department. By this method of dual control responsibility for defects can be shifted from one department to another. The Surveyor should have full control up to the house connection, manhole or intercepting trap; from this point all control and responsibility should rest with the Health Department, the Inspector being responsible to his committee for

the soundness of the drains, soil-pipes and fittings connected therewith; thus extending to new buildings the same principle that applies to old premises. There is no branch of domestic sanitary work that a fully trained sanitary inspector is not qualified or capable of pronouncing a judgment on equally with an engineer. This argument is supported by all local authorities, in their placing the supervision of all sanitary work of occupied houses, whether they be cottages or mansions, under the control of their sanitary inspector. Again new premises, the sanitary work of which has just been supervised by an expert engineer or the Surveyor's Department, having become occupied, immediately, if the owner so wishes, he calls in the Sanitary Inspector from another department, who is then in a position to advise alterations or extensions of the sanitary fittings. This causes unnecessary expense, loss of confidence on the part of the public in the municipal authorities, and possible friction between two well-meaning departments. If one department was responsible for all house drains in new as well as old premises in all stages of construction, then greater confidence would prevail on the part of the public.

CONGRESS AT BRADFORD.

CONFERENCE OF LADIES ON HYGIENE.

SIMPLE HOUSE-FURNISHING AND DECORATION.

By Miss HERMIONE UNWIN.

ABSTRACT.

THOUGH the hygienic, artistic, and economic aspects of the subject of house-furnishing are not often considered to have much in common it will be found on examination that the principles on which they are based, though not similar in themselves, all prove that simplicity is desirable. A house furnished on really artistic principles will be healthy, convenient, comfortable, and not overcrowded, though the common misuse of the word "artistic" often gives rise to erroneous ideas on this matter.

The aim in furnishing a house should be to ensure the good health and general well-being of the occupants, so far as these are dependent on their habitation. Fresh air, light, and cleanliness are the principal factors in promoting these conditions, and the furniture and arrangements should be such that these may be attained with the minimum of labour. The less furniture the less labour is necessary to keep it in proper order, and what there is should be simple in design and construction so that it may be easily kept clean.

Though open windows are essential to health they freely admit dust which is prejudicial, and therefore as few places as possible should be provided where it may harbour. Elaborately carved furniture, curtains and draperies, ledges of picture frames and mouldings, ill fitting flooring, corners and angles between walls and floor, heavy wardrobes which are

Note.—The proceedings of the Conference commenced with an Address by Mrs. J. A. Godwin (*see page* 218).

seldom moved, all offer opportunity for dust to accumulate, and should not be unnecessarily provided. The air space should not be unduly diminished by the furniture, and provision should be made for the free passage of air in all parts. Windows should not be obstructed with several layers of curtains which keep out both light and air, and increase the amount of necessary washing. Sunlight being a natural purifier and disinfectant, should be freely admitted.

From an artistic point of view every article must be well adapted to the purpose it has to serve, and should express its function in its construction. It will then probably possess the beauty of fitness even if it is not intrinsically beautiful. Overcrowding spoils the general effect of a room, and carving and ornamentation, besides being excellent dust traps, are frequently used to cover up bad workmanship, whereas simply designed furniture must be well made in order to pass muster. The general colouring of rooms is of great importance, and can have a marked effect on the mental health.

Some ornaments and other means of decoration are as essential as purely useful articles, in recognition of the fact that man has other needs than those of food, shelter and physical comfort, and the better examples these ornaments are of their kind the fewer of them will be needed. William Morris's dictum should be carried out in practice, "Have nothing in your house which you do not know to be useful, or believe to be beautiful."

One way of meeting the increasing difficulty of finding servants is to reduce the amount of housework so as to need fewer of them, and to this end simply made furniture and as little of it as is compatible with comfort and convenience will help. A small house should not be a copy in miniature of a large one, as the style of living of the people in the two houses cannot be identical, but in the former the question should be asked about everything "Is it not possible to do without it?" so that all superfluous articles may be eliminated.

HOUSEHOLD BACTERIOLOGY.

By Miss MAUD CURWEN.

(Associate.)

ABSTRACT.

IN CONSIDERING the relationship to daily life of the actions and habits of micro-organisms, it is desirable not to dwell too exclusively on their special action, but rather to realise the broad ways in which our knowledge of them can be applied to a scientific and hygienic care of the dwelling house. The majority of bacteria are not only harmless, but of vital importance to us, and, with the exception of a few places, exist everywhere. They are directly responsible for fermentation, putrefaction, and decay. Micro-organisms require, like seeds, the right soil and the right place before they can grow, as well as certain conditions to enable them to develop. Broadly speaking, they may be divided into yeasts, moulds, and bacteria, and the last into *saprophytes* and *parasites*. Saprophytic bacteria grow in dead matter, and parasitic bacteria in living matter, these latter being the germs of disease. Conditions suitable for the growth of micro-organisms are (1) moisture, (2) warmth, and (3) darkness. Bacteria while dry are in a latent condition, but ready to develop so soon as moisture is applied to them, or they themselves settle on a damp surface. At very low temperatures the growth is checked, but not necessarily killed, while a summer or room temperature will be highly suitable for a very large number and cause rapid development. Direct sunlight will kill bacteria rapidly, and even diffused sunlight has a strongly deterrent effect upon their growth. Darkness is favourable to their development.

Dust in houses contains large quantities of bacteria, and should be removed by careful methods and not merely moved from one place to the other. The dust should not be allowed to rise and fill the air during sweeping and dusting, if so, it will slowly settle again. Damp tea leaves, etc., and carpet sweepers should be employed and damp dusters wherever practicable. Ordinary deal floors needing frequent washing are easy

growing grounds for germs which have settled in the seams; closely laid polished floors are far more hygienic.

Sunny rooms, fresh air, wide windows, opening at the top as well as at the bottom are primary requisites for health. Larders require to be carefully built; to be well away from any source of contamination; to have windows properly screened, to have through ventilation, and to be well lit, dry, and scrupulously clean. Hard impervious glazed materials should be used wherever practicable.

In the dairy, micro-organisms are both useful and dangerous. Even slightly tainted milk means the growth of putrefactive organisms and should not be drunk. Boiling practically kills all bacteria except resistent spores. Broadly speaking, milk contains lactic acid organisms and enzyme producing organisms. The bacteria of disease are killed at the lower temperature as in Pasteurizing milk, but as this temperature kills the lactic acid bacteria also, which act as a check upon enzyme producing bacteria, Pasteurized milk for infants should not be kept any longer than fresh milk. It has, however, decided advantages over boiled milk. Milk vessels should be scrupulously cleansed and scalded; carelessness in their cleansing may mean death to children through diarrhœa.

The mouth is a place where entering germs find ideal conditions for growth. A neglected mouth means that bacteria grow and produce acids which attack the tooth enamel and open the way for the entry of the organisms of decay. Neglected teeth are frequently the originating or aggravating cause of disease.

PUBLIC DAY NURSERIES.

By Mrs. MOSER.

ABSTRACT.

THE introduction of public day nurseries urged as a means of diminishing disease amongst children and reducing infantile mortality. When the Education Acts of 1870 were passed, the adoption of some such provision was expected for the infants of working-women whose brothers and sisters could no longer act as caretakers. No such provision being made, the child is generally left to a neighbour—often old, ignorant, and very poor.

The idea of relieving a mother of these duties is opposed by some, but the nursery would not supplant but supplement the mother who is obliged to go to work, and would prevent the child from being the victim of these circumstances.

Public day nurseries should also be educational centres, spreading a knowledge of the sanitary and hygienic needs of infant life, our high infant mortality being due mostly to ignorance of the feeding of infants. Statistics prove that in some districts the infant death-rate is out of all proportion to that of other districts where more favourable conditions prevail, but no statistics shew the suffering involved, nor the numbers left incapacitated. Of that we have daily experience in a small public nursery in Bradford, where numbers of children are received suffering from ignorance and neglect in regard to previous feeding.

In such institutions an efficient staff should also give moral and mental training, and form good habits and healthy desires in the children. The nurseries should be small and scattered, near to the homes of those using them. The rooms light, airy, and sunny; and play-ground or open verandah essential. Careful arrangements for bathing, clothing, and feeding, so as to minimise risk of infection. Dietary and other arrangements under supervision of medical officer. A fee should be charged for admission, but such an institution could not be self-supporting. Suggested

that buildings for the purpose might be provided by municipalities, where Acts for the Housing of the Working Classes are being put into force.

In other countries public day nurseries are in most industrial centres an important branch of philanthropic effort. In France they are most fully developed, the first having been established there in 1844. There are now 303 in France. In Paris the 66 nurseries accommodate 2,466 infants; and in 1901, besides large sums from voluntary contributions, the municipality gave £5,400. These nurseries are subject to public inspection in matters of hygiene; and regulations as to feeding, the use of sterilised milk, style of feeding-bottle, are most strict; and the importance of children being breast-fed insisted on. Courses of lectures are also given in the nurseries to young women.

The advantages public day nurseries would help to promote are:—

For the Child—Health, full physical and mental development, habits of regularity and self-control.

For the Mother—Education in the laws of hygiene and sanitation.

For the Family—Opportunity for self-help, without neglect of the child.

For the Community—Relief in the cost of maintaining those whose failure in life is due to early neglect.

THE INSPECTION OF HOME-WORKERS.

By Miss MARGARET L. SHARPLES.

THE question of home-work has been beset with difficulties. On the one hand there is the praiseworthy and proper reluctance to interfere in home life, and the fear of depriving those who are prevented from entering factories and workshops of a means of livelihood. On the other, there is the need for the out-workers of some share in the protection which the inside hand enjoys. Again, there is the right of the consumers to be assured that the goods which he buys are not made under conditions of disease and dirt. Sweating has been defined as unusually low rates of wages, excessive hours of labour, and insanitary work-places, and it might well be urged against more stringent factory and workshops legislation, that, as these conditions were driven more and more out of workplaces protected by inspection, they would find a refuge in the hidden and unprotected dwelling of the home-worker.

It was not till after the Report of the Committee of the House of Lords on Sweating had been issued in 1890, that the existence of the out-worker was legally recognised by the Factory Act of 1891. By this Act the employer was bound to keep a list of the names and addresses of persons employed by him outside his factory or workshop if so required by an order of the Secretary of State, such lists being open to the inspection of H.M. Inspector of Factories, and of the Medical Officer of Health and his assistant officers. When the order was made it included all work incidental to the making and repairing of clothing, electro-plate making, cabinet-making and upholstering, and file-cutting. The list has since been extended, and fur-pulling, among other trades, has been added.

When, four years later, another Factory Act was passed, the defect of a serious omission was remedied. By the addition of the word "place," work which was given out from neither factories nor workshops, but from shops and houses, was included. It was also required that the lists which, hitherto, had only been kept for inspection, should be sent twice yearly to the Factory Inspector. It was then made actionable for any employer,

knowingly, to allow clothing to be made on any premises where an inmate was suffering from scarlet fever or small-pox. This Act contained a clause which, at first sight, seemed to be all that was needed in dealing with unhealthy conditions in the dwellings where the work was done. In practice, however, the section was found to be quite unworkable and useless.

Early in 1900 it was decided in Leeds that attention should be specially given to the inspection of the houses of home-workers. At that time, as I have shown, our legal powers, apart from those conferred upon us by the Public Health Acts, were limited to the right of seeing the lists kept by employers and the power of dealing with the manufacturer who knowingly allowed his work to go into small-pox and scarlet fever houses.

With the exception of some skilled and therefore better paid hands working at the bespoke-tailoring and boot trades, and some pinafore and blouse makers, home-work in Leeds generally meant, and still means, the machining and finishing of garments given out by the wholesale clothiers, and the making of soft slippers and children's ankle-strap shoes. The clothing is nearly all made by English women, though the employers are often Jewish; while the soft slipper trade is almost, if not entirely, in the hands of the Jews. It is for the most part coarse and unskilled work, paid, as coarse unskilled work always will be paid, by a very low rate of remuneration.

It is difficult to find the time wage earned by irregular workers, but I estimate that a penny an hour is not an unusual rate of payment for clothing finishers, and out of this there are generally sewing materials to provide and often fire and soap for pressing. The workers as a rule are those who are prevented by age, ill-health, or the care of young children, from entering the factories and workshops. Sometimes the wife of a skilled workman will be found earning pocket-money in her spare time, but the greater number are those engaged in a serious struggle for daily bread. Labourers' wives with large families are ekeing out the low wages of their husbands; old couples past work are trying to keep their independence a little longer—the old man pressing and putting on buttons, while his wife sews, women are working day and night to provide themselves and often their families with the barest necessities of life.

At first the lists kept by employers were very incorrect. Wrong names and wrong addresses were given, and it was not an uncommon experience to find after seeking diligently for the greater part of an hour, that the person sought had died or left the town some years before. The

doors of the houses were often locked, because the women were away fetching their work. Sometimes as many as fifteen to twenty might be visited in a day and only three or four inspections made.

Houses are thoroughly examined from bedroom to cellar. Cases of over-crowding are dealt with, sanitary defects reported, cleanliness enforced, and efforts are made to prevent the work from being brought in contact with infectious disease.

By the Factory Act of 1901, our position in relation to home-work was very much strengthened. Lists of outworkers instead of being sent to the Factory Inspector, must now be sent to the District Council—practically to the Medical Officer of Health. These must be examined, and the names and addresses of those whose places of work are under other authorities must be forwarded to those authorities. This does not affect us much in Leeds, but in London such a regulation must be essential to any systematic inspection of this kind. The responsibility of the employer is considerably increased. If he send his work into any place after receiving one month's notice from the District Council that that place is injurious or dangerous to the health of the workers, he may be fined. In addition to the old regulation with regard to small-pox or scarlet-fever, an order may be made forbidding work to be taken into any house where an inmate suffers or has suffered from any notifiable disease until disinfection has been effected, and other proper precautions have been taken. An order made by the Secretary of State now requires that lists should be kept correctly, and up to date.

Last year 1,024 complete inspections of the houses of home-workers were made in Leeds, and 1,172 visits were paid.

After three years' steady inspection we ask what has been done?

I might give you some statistics of the number of houses cleaned and limewashed, and of the sanitary defects remedied, but one feels more and more that these things are only means to an end, that end being the raising of the standard of healthy living, the wakening of a sanitary conscience in the people themselves, and the increase of self-respect. Such things cannot be expressed in figures, they get into no report, and of their growth the worker himself is often unconscious. The home-workers have so much to keep them back, there is the coarseness and monotony of their work, the fight against time, and often the struggle to live two lives at once. Nevertheless, I believe that there has been a real though very gradual levelling up in their condition.

AMONGST THE OUTWORKERS.

NOTES FROM A PAPER

By Miss M. L. BROWN,

Lady Inspector, Manchester.

ABSTRACT.

THE importance of this branch of factory work may be estimated from the fact that nine sections of the Factory and Workshops Act are devoted to regulations affecting homework; and also from the circumstance that the Home Office asks for special reference to the matter in the annual report.

The powers referred to, aim at the prevention of work being done in dwellings which are injurious, or dangerous, to the health of persons working therein.

The home-work in this part (Manchester) consists mainly in the making of wearing apparel. As provided in the Act, we receive the lists from the factories and workshops twice a year, in February and August. From these a register of employers is compiled which is corrected every six months, as the returns show new ones to be added, or discontinued ones struck off. As a continuation of the process, and for my own convenience, I construct a visiting register from the names and addresses supplied by the lists, and this is subject to a similar revision as changes occur.

With this visiting register I proceed to visit systematically. Those houses which are clean and tidy need very little supervision, whilst others of the reverse description require frequent and persistent attention. What strikes one most in visiting is the discrepancy between the domestic condition of such houses and the official notion of cleanliness, for betwixt the two things there seems to be an impassable gulf. In the worst cases we serve a cleansing notice; and if this is not complied with police-court proceedings follow, and as often as not the case is adjourned to give further time for compliance. It is worthy of remark that the cleansing notice referred to specifies walls, floors, and ceilings, but this does not go to the root of the matter, as it leaves untouched much personal uncleanliness and domestic dirt, which is "as infinite in variety as Cleopatra's charms."

Let us enter one of the houses, say one of the worst specimens:—Two rooms upstairs and two downstairs; the parlour let off as a combined room; in the kitchen the family live. An air of general untidiness fails to describe it. Almost before you enter, you are met by the fetid smell and wonder how people can endure it. The stuffiness is to be accounted for by the want of ventilation (doors and windows being closed), dirty clothing, unwashed persons, and the presence of dogs and cats. You may notice the ashes protruding from under the fireplace, dirty windows and curtains, dirty ceilings and walls, furniture with cushions and covers all dirty. There may also be several dirty children playing about the room. On the table no cloth, the remains of several meals, with such additions as a comb, a hat, collar, tie, a small gas-stove, a frying-pan, shoes, and some raw meat for the next meal.

Strange to say, the inmates never think of mending their clothes, but wear them as they hang. The stitch in time has no place in their economy, and what they earn as outworkers really amounts to very little. Here it should be stated that when they work inside the factory, where they give their whole time and undivided attention to the work during statutory hours, they can earn respectable sums, but it is when they come to alternate such work with domestic duty (however slight) and a liberal amount of gossiping that their earnings appear meagre.

I am inclined to think that frequent and persistent visiting does some appreciable good, except in the very worst cases where the domesticity is beyond redemption. The great problem, to my mind, is this: what would induce this particular class to love order, decency, and cleanliness for the sake of the increased comfort which, as a matter of course, always accompanies the practice of such household virtues? and I should welcome any supplementary influence that would reach the mass, for it seems to me that you cannot make people clean by Act of Parliament any more than you can make them sober by that means, for in either case legal coercion would only be applied to the extremists.

We may welcome the work being done in schools where hygiene and domestic economy are being taught, for it is to the rising generation that we must look, but that is in the future.

For the present, I would suggest that it would be an advantage that outworkers should be licensed to take in work, and that such license should only be granted after inspection of their homes, and I also think that the powers of entry should be clearly defined. This would strengthen our hands.

THE PERSONAL HYGIENE OF CONSUMPTIVES.

By Miss I. M. PRIESTMAN.

ABSTRACT.

THE schools for the satisfactory study of the hygiene of consumptives being undoubtedly the sanatoria for the treatment of phthisis, it is well to lay stress upon the importance of sending patients whenever possible for treatment to a sanatorium. It is from the standpoint of patient and nurse at such an institution that this paper is written.

"The person of the consumptive is not directly infectious," but "the vehicle of infection is the actual expectoration" (Dr. Philip, Edinburgh), and there are not many people who do not know that the sputum *dried* sets free in the dust of the air the tubercle bacilli, and yet how careless the average patient (and surely his doctor also) of the danger he is as he expectorates in the streets or into his handkerchief. Dettweiler's pocket flasks (3s. 6d.) are within reach of most purses, and where this is not the case is it impracticable that the sanitary authorities of the town should supply such flasks on application? With a flask, containing a teaspoonful or two of 1-in-20 carbolic, the infectious contents of which are regularly burnt, the greatest source of danger may be obviated.

Though public opinion as to the importance of fresh air is making rapid advances, it would astonish many to learn what the open-air treatment means from the point of view of the cure of phthisis. "The patient is to be bathed in fresh air day and night, irrespective of weather." This means that whenever possible he is out of doors all day long, and even if confined to bed his room is so arranged that the maximum of fresh air and sunshine is his for the whole twenty-four hours. There is not such a word as draught in the sanatorium vocabulary, for as we do not speak of draught when the wind blows round us out-of-doors, so free is the access of air throughout the sanatorium building that the word seems equally out of place there.

When a patient has learned to crave for this freedom of air, feeling it to be his very life, he has learned a lesson of the utmost importance to the restoration and maintenance of his health.

Loss of appetite is an almost invariable accompaniment of phthisis, but no patient at a sanatorium may say "I cannot eat"; he must and he does eat, and that largely, and his gradual increase in weight tells that the victory over disinclination has not been in vain. The amount of food given is sufficient to enable the patient to increase in weight until he is half-a-stone or so above the normal, and then to enable him to maintain the same. This does not involve the disgusting amount of stuffing sometimes associated with the idea of sanatorium treatment. The patient being himself a poor judge of the right amount and character of the exercise, which is an important factor in his cure, the same is regulated entirely by the doctor. Walking, at the rate of two to three miles an hour, is the form of exercise always prescribed; the more active forms of exercise, which put a sudden strain upon heart and lungs and induce rapid and shallow breathing, are forbidden. Nothing is allowed to interfere with the regular hour's rest before meals. Nervous instability being a trouble which phthisical patients have to contend with, a quiet regular life is of inestimable value. Early to bed and to rise, regular meals, regular exercise, regular rest hours. Warm clothing is a necessity upon which, in such an open-air life, it is not necessary to lay much stress; but it is important that it should be light as well as warm; long and heavy skirts, which impede walking, and any garments which restrict chest-development are, of course, to be condemned.

The phthisical patient must intelligently co-operate with his doctor if he is to win in the battle with his disease. He needs also an infinite store of patience and wise persistence, not only that he may be cured, but that he may maintain that cure by bringing, at any rate, the principles of the treatment to bear upon his ordinary life.

HYGIENE IN ELEMENTARY SCHOOLS, AND ITS BEARING ON HOME LIFE.

By ANNIE ROTHWELL, Cert.San.Inst.

Sanitary Inspector, Oldham.

(MEMBER.)

ABSTRACT.

MY reasons for offering this paper are two. *First*, that having myself been a teacher in elementary schools both as assistant and head, I know the wonderful influence that teachers have over the children of the present day, who are to be our future citizens and parents of the future generation. *Second*, that now holding the position of Sanitary Inspector I see the great necessity of sanitary authorities obtaining the sympathy and aid of elementary school teachers to make the unhygienic homes of the population hygienic.

Therefore, what sanitary authorities require to do is to obtain this sympathy and aid of elementary school teachers, who will bring into action their well-known saying, "To get at the parent get at the child," thereby instructing at the same time both future parents and parents of to-day. When a child's interest is aroused in a subject it is certain to convey a portion of the instruction home. Take, for example, the boy who is receiving manual instruction, and the girl cookery and laundry lessons. Consider then what a child would do, at home, in the appliance of hygiene.

As regards the method of teaching this subject let it be practical, using the school for both illustration and experiment. Many people say it is useless to attempt the teaching of hygiene in a school not constructed on the best hygienic principles. Here ask this question: Are these children's homes built on the best hygienic principles? No, far from it. What we are to do then is to teach the children how to make use of what appliances they have, comparing at the same the advantages of a home built on hygienic principles. The outcome of such teaching will be that future sanitary authorities will have to be on the alert, for these future parents and householders, as ratepayers, will not suffer their children to be reared in houses such as they had.

Now comes an important question: Should hygiene be made a special

subject in the school course? Opinions may differ. But with what object is hygiene to be taught in schools at all? Is it in order to obtain a good report from the inspector on the pupils' knowledge of the subject, accompanied with all its scientific terms? or, is it to obtain its practical appliance in their own homes? The latter certainly. If hygiene becomes a special subject, it must find a place on the school time-table and be subject to inspectors' reports. If such be the case, then it will become another burden to the already over-burdened elementary school teacher, and the true object of its teaching will be lost.

This does not mean that to give children of elementary schools a sufficient knowledge of practical hygiene for their own homes it is necessary for them to have a knowledge of physiology, chemistry, and physics, in all their scientific terms. Hygiene can be taught in simple terms that can be understood by elementary school children.

Hygiene ought to be a home-training, but with the parents of to-day it cannot be. Let sanitary authorities obtain the help of school teachers, then hygiene will reach the homes of their scholars: it is certain. Who are more fitted to take up this so much needed branch of work than the teachers themselves, in whose care these children are for two thirds of a year, and for a period of at least eight years?

To avoid this teaching of hygiene becoming another burden to the teacher, special teachers of the subject may be appointed. These teachers would pay periodical visits to the schools, and give lectures on the subject. The school staff would then be only too willing to keep the information thus imparted always in the children's minds, and encourage its practical use at home.

The "Certificate of The Sanitary Institute for Hygiene" for such teachers stands high, and the course of training, held at Bedford College, London, is open only to certificated teachers, or to teachers having had two years' experience in secondary schools, which is a good proof that the teaching of hygiene must fall to the lot of school teachers if it is to reach the homes of the parents of to-day.

CONGRESS AT BRADFORD.

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

SOME OF THE MEDICAL PROBLEMS OF PUBLIC ELEMENTARY SCHOOLS.

By H. MEREDITH RICHARDS, M.D.Lond.

Medical Officer of Health, Croydon.

(Fellow.)

WHEN asked by your President to read a paper I responded with pleasure, though with some trepidation, as, in spite of many pre-occupations, I felt that at a conference such as this there would be a welcome opportunity of eliciting the opinions of experts on many questions of principle and detail which are of more than usual interest at the present moment, and which could be appropriately discussed in a city which has long taken an active share in the solutions of the problems involved. As a corollary to the abolition of School Boards it will be possible, and in many instances necessary, for school authorities to revise the standing orders relating to the health of the scholars. Furthermore, the fusion of educational and sanitary authorities offers an unique opportunity not only for new departures, but for so arranging matters that the maximum benefits may be obtained with the minimum amount of friction, and with the least possible demands on the time and energy of teachers, attendance officers and sanitary staff.

Though I do not on this occasion intend to enter much into detail, it is necessary to consider the chief directions in which activity is called for.

In the first place, it will probably be generally recognised that, in respect to the health of school children, local authorities have both duties and opportunities. It will be convenient to discuss them separately.

The proceedings of the Conference began with an Address by James Kerr, M.A., M.D., D.P.H. (*see page* 221).

The following are the chief *duties* which arise in connection with children attending public elementary schools :—

(1) To insure that children do not attend school while suffering from infectious disease, or while liable to carry infection.

(2) To insure that children are physically fit for compulsory attendance to be enforced without the production of bodily or mental injury, and that the curriculum is arranged with due regard to the capacities of the children.

(3) To insure that school premises shall be in such a condition as shall not be detrimental to the health of the children.

Infectious Diseases in School Life.

It is unnecessary at a Conference, such as this, to discuss the part played by school attendance in the spread of infectious disease. That it is a very large factor no one will deny. Apart from the amount of sickness occurring among those attending school, house epidemics of such diseases as measles, whooping cough and diphtheria are frequently to be traced to a child who has been infected at school, and fatalities under three years of age are not seldom the result of infection from an older child. It is, indeed, in this indirect way that school epidemics of measles and whooping cough mainly affect the mortality tables. It is, therefore, essential that no effort should be spared to minimise the influence of schools in this direction. The exact methods to be adopted will naturally vary according to the disease in question and the degree of prevalence.

The Notifiable Diseases.—In the case of the notifiable diseases (scarlet fever, small-pox, diphtheria, enteric and typhus) initial information will, to a large extent, be derived from the notification-certificates which the medical attendant is bound to forward to the sanitary authority. But even when dealing with these diseases, satisfactory results will not be obtained unless notification be supplemented by measures which will lead to the discovery of the slight unrecognised cases which are, probably, responsible for the majority of school epidemics.

To detect these cases it is needful that all school teachers should be trained to look out for, and to recognise, the cardinal symptoms of these diseases. It is not, of course, to be expected that teachers should be competent to make the diagnosis of diphtheria or scarlet fever, but they might readily acquire enough elementary knowledge to suspend from attendance children attacked with sudden vomiting and headache, or complaining of sore throat, or exhibiting enlarged cervical glands. In other

words, to treat as suspects children for whom a rational parent of the more affluent classes would seek medical advice. Similarly they should carefully scrutinise the condition of children resuming attendance after a temporary indisposition, more especially when there has been known or possible exposure to infection. The attendance officers also should be trained to be on the watch for similar conditions.

Every suspect, whether discovered by the teacher or by the attendance officers, should be referred to the medical officer and excluded from school until the case has been cleared up. When the child is sent home the parents should be notified of the reason and urged to seek medical advice. The sequel in my own town is to send one of the women health visitors to the house of the suspect. In many cases the parents will have called in their own medical attendant and his opinion will be available. If not and there is *prima facie* evidence of one of the more serious infections, means should be provided whereby a medical diagnosis may be made. For this "free diagnosis," as Dr. Newsholme calls it, the plan suggested by Dr. Spottiswoode Cameron appears most satisfactory, viz.: an arrangement with a certain number of practitioners in the district to give certificates of diagnosis in cases that are referred to them. In the case of sore throat it is our practice in Croydon to get the health visitors to obtain a swab for examination at the Borough Laboratory, if there is no medical attendant. If a medical man has been called in, we usually send him an "outfit" with a note to the effect that a swab will be examined if thought desirable. A good many cases of diphtheria are thus discovered.

Some such scheme is probably more efficient than the daily visit of a medical man to each school. As will be suggested later, periodical medical inspection of schools is most necessary and helpful, but daily inspection of the many hundreds of children attending the larger schools could not but be a perfunctory performance as anyone is aware who has attempted the examination of even a single standard. In special cases, however, as for instance when it is suspected that some unrecognised case of diphtheria is still attending school, the detailed examination of the infected class by a medical man is most useful and often checks a class epidemic, as many of us have experienced and as Dr. Heaven has recently shown to have occurred in Bristol and its environs (Public Health, June, 1903, p. 516).

The non-notifiable diseases.—In the case of measles, whooping cough, mumps, chicken-pox, or impetigo contagiosa, the procedure is much the same, except that the medical department is generally entirely dependent

on the voluntary notifications of teachers and attendance officers. This information should be supplemented and checked by similar measures to those just indicated, viz., visits by health visitors and provision for medical diagnosis where necessary.

Ringworm can, I believe, best be dealt with in urban districts by establishing special classes. It would however be interesting to hear what results have followed in cases where children suffering from ringworm have been allowed to resume attendance provided their heads are covered with close-fitting caps.

The establishment of ringworm classes would in most cases need to be supplemented by medical attendance at the expense of the Education Authority if the best results are to be obtained. The poor cannot afford to pay for the tedious and painstaking attention which these cases require, and as ringworm is frequently acquired at school, it does not seem unjust to treat it at the public expense.

Pediculosis.—Probably the best plan is to arrange for a weekly inspection of heads and to exclude verminous children until their heads have been efficiently treated in some such way as that recommended by the Boston (U.S.A.) Health Department ("School Hygiene," Newsholme & Pakes, p. 179).

Ophthalmia.—In day schools it is possible that granular ophthalmia is the most important source of trouble, but I should be interested to hear from the Ophthalmic Surgeons present what other eye-conditions they would recognise as calling for the exclusion of children from day-schools on account of a substantial risk of infection.

Children must be Physically Fit for School Attendance.

This suggests many difficult problems.

General health.—Here again the intelligent oversight of a careful teacher is invaluable. Marked anæmia, slight chorea, faulty positions, evidences of overpressure are all matters to which attention should be directed. If the parents consider the child unfit to attend school they should seek medical advice and obtain a certificate from their medical attendant. As a rule this is simple and sufficient, but it must not be forgotten that occasionally parents will, for purposes of their own, mislead the practitioner they select and obtain certificates that are not warranted by the facts. When this is clearly the case the medical officer should be referred to and a consultation suggested. Certificates given to hospital outpatients are often of this unsatisfactory nature, as all of us who have held hospital appointments cannot but remember. The difficulty arises

from the simple fact that it is often impossible in a brief interview to be sure that the catalogue of subjective symptoms from which a child is said to be suffering is pure fiction, invented with the object of evading school attendance. A consultation often puts this right, or in other cases suggests the possibility of arranging for attendance for half time, or some similar compromise.

Defective children require to be examined before admission to a special department.

Special Senses: With regard to hearing.—Teachers should advise parents to seek medical advice in all cases of ear discharge. They should also be familiar with the association of deafness and adenoid disease. Neglected cases, and especially those which are so marked as to interfere with school work, should be presented to the medical officer at his next visit, in order that he might bring further pressure to bear on the parents.

With regard to sight.—This requires far more attention than is usually devoted to it. Each child should have its vision tested. Ideally this should be done by an Ophthalmic Surgeon, but in practice it is probably sufficient for the teachers, by means of test cards, to select the children with defective vision and present these to the Ophthalmic Surgeon when next visiting the school. So far there is no great difficulty, but the question now arises as to what the next step should be. Should the Ophthalmic Surgeon prescribe for those requiring attention, or should the Educational Authority content itself with warning the parents of children with defective vision to seek medical advice? In the latter case, as Dr. Kerr has recently shown (Report to School Board for London, February, 1903), either nothing is done or an unfair burden is cast upon the voluntary hospitals. In my own town the difficulty has, to a large extent, been met by the fact that the Ophthalmic Surgeon to the School Board is also Surgeon to the eye department at the hospital. It has been his practice to transfer to his Out-patients any child found in urgent need of treatment. It seems not unlikely, as Dr. Kerr suggests, that ultimately the School Ophthalmic Surgeon will, at any rate, have to *prescribe* for errors of refraction.

Unfortunately, the difficulty of securing treatment is not confined to cases of eye trouble. Cases of adenoids, impetigo contagiosa, itch, and pediculosis are equally liable to be neglected. In the case of adenoids, expert surgical assistance should be placed within reach of those needing it, perhaps by the Educational Authority subscribing to the local hospital and obtaining a sufficient number of Out-patients letters. In the case of such affections as impetigo contagiosa and pediculosis, the full responsi-

bility must be left with the parents, who can, as Dr. Crowley suggested to me, be brought to the notice of the Inspector of the N.S.P.C.C. if they will not secure treatment from their own medical attendant or from the poor law medical officer. Itch may perhaps be treated by the Sanitary Authority under the Cleansing of Persons Act, as institution-treatment is almost essential for this affection.

The Structure and Use of School Premises and Furniture.

Apart from initial defects in construction, many schools are rendered unhealthy by overcrowding, inefficient ventilation and heating, insufficient and unsuitable cleansing, unsatisfactory furniture and imperfect lighting. Routine visits of the medical officer are of service in calling attention to these matters. Overcrowding in special departments is far too common. It would be well if the head teachers were required to enter in the log-book every occasion in which a room was overcrowded. Arrangements ought also to be made for a periodical report on the sanitary conditions of the premises being made to the local authority and to the Board of Education.

Opportunities for the useful application of medical knowledge in school life are almost unlimited, and can only be briefly indicated.

In the first place, the unconscious lessons which children imbibe from their surroundings are ample justification for suggesting that school buildings should not only be unobjectionable, but should serve as models of sanitary excellence. The class-rooms, for instance, should not only be clean and sufficiently lighted, but should be as bright as it is possible to make them. Even when the buildings are beyond reproach, caretakers often require more careful supervision than they now get.

Middens and trough closets should be abolished and replaced by ordinary water-closets, which the children should, if necessary, be instructed not to destroy. Lavatories should not only be clean but look clean. *The cubic space per child should be greater than is usually the case.* Heating power generally wants increasing, so that ventilation may be more easily carried out without complaint. Classes on the other hand should be reduced in size, and schools, especially infants' and junior schools, should be smaller or split up into a larger number of units. Teachers should be thoroughly grounded in the principles of hygiene, so that they could not only instruct scholars, but carry out the standing orders as to health with zeal and intelligence.

The teaching of the elements of hygiene should be compulsory in the higher standards. This could readily be effected by means of a suitable reader without unduly overweighting the curriculum. Indeed, I believe

that, for children, a properly arranged reader would prove more effective than the ordinary elementary text books of hygiene. Such a reader would enforce the principles of ventilation, not by abstractions about CO_2, nor even by test tube experiments with lime water, but by concrete examples, such as the history of the Black Hole of Calcutta, while the need for disinfection after infectious disease might be inculcated by a short account of the recent outbreak of typhoid which was traced to blankets returned from South Africa.

The older girls should have special instruction in regard to the care of infants. This could be made both interesting and practical by demonstrations at neighbouring crèches.

Machinery.

I do not propose at this Conference to discuss at length the various issues that may be raised, but would suggest that there is need for readjustment at both the centre and at the periphery of our educational system.

With regard to the Board of Education, the chief difficulty appears to be a want of appreciation both of the magnitude of the interests involved and of the actual condition of a large number of elementary schools. Apparently the Board are content as long as, like other departments, "they can muddle through somehow," to quote Mr. Long's apt phrase, or they would not have suggested in reply to the recommendations of the Society of Medical Officers of Health, that all was for the best in this best of all possible worlds, and that as regards hygiene, they have already provided "sufficient security for the sanitary state of the premises of elementary schools." (Public Health, vol. XV., p. 367).

Again, the ill-timed withdrawal of Section 101*, which enabled Local Educational Authorities to receive grants in respect of children kept from school on account of infectious diseases, is much to be regretted. It is true that theoretically this course can be defended, as it may be urged that the exclusion of infectious children will, in the long run, improve the average attendance, and those districts which exercise least supervision will eventually pay for their neglect by earning smaller grants. Yet, as a matter of fact, Article 101* was of very considerable practical importance, especially in non-progressive districts, where careful exclusion of slight cases of infectious disease was, with difficulty, obtained.

Other matters, for which we must look to the Board of Education, are the necessity for raising the standard of cubic space per child (especially in the older schools), a minimum standard of ventilation, and periodic

reports by the Medical Officer of Health on the sanitary condition of all school premises.

With regard to the local machinery, every education authority should be expected to secure the services of a medical adviser. As to whether that medical adviser should usually be the medical officer of health I do not at the moment offer an opinion, but whether that should be so or not, I am confident, from my own experience, that it is of the greatest importance that the arrangements should be such as to insure that education authorities and health committees work in perfect harmony for the end that both have in view.

In any case it is not unlikely that Procrustean methods are inadvisable, and that administrative measures which are applicable in large towns will naturally require modification in rural districts. For instance, in London and the great towns specialization will naturally be carried further than will be possible elsewhere.

In no case, however, are the difficulties unsurmountable if we unite in demanding that public schools shall be conducted with due regard to medical science, and that they are everywhere permeated by a sanitary atmosphere.

(For discussion on this paper, see page 792.*)*

INDIVIDUAL EXAMINATIONS IN ELEMENTARY SCHOOLS.

By R. LISHMAN.

THE system of elementary education in vogue in England from 1864 to 1895 was based on the principle of payment by results. Once a year the children were individually examined by Her Majesty's Inspectors of Schools, and the amount of Government grant apportioned to each school depended on the accuracy with which its pupils could reproduce the knowledge they had imbibed during the preceding twelve months. All children from five years old up to twelve or thirteen were examined, and were then obliged, as a rule, to be promoted to the next higher standard. Every attempt to secure exemption from examination, on the plea of ill-health, irregular attendance, or natural dulness was rigidly scrutinised, and anything above a small percentage of exemptions resulted in loss of income to the school, and of reputation to the teacher. As public money was being distributed over a wide area, it was inevitable that an attempt should be made to establish uniformity of standard throughout the country, and thus the ill-fed and irregular children from the slums were subjected to the same ordeal, and expected to reach the same level of accuracy, in all subjects, as children from good homes. It was apparently assumed that all children of the same age possessed the same natural endowments, and had reached the same stage of mental development. The results thus obtained were, of necessity, premature results born out of due time, and could not be secured by truly educational methods, which recognise the gradual growth of the child mind, but only by the tricks and short cuts of the crammer. The system was, however, useful in the compilation of blue books; and statistics of passes and failures afforded a rough and ready method of estimating a small portion of the work done in school. Although the system was abolished in 1895, by the pressure of enlightened educational opinion, some large school boards retained the plan of having the children in their schools examined individually, at least once a year, by their own inspectors. A recent report

of certain Inspectors of the London School Board complains of inaccuracy in the work done by the children, and shows an evident desire to have some scheme of individual examination re-introduced. Most probably as a result of that report, in the edition of the New Code just issued by the Board of Education, His Majesty's Inspectors are empowered, at their own discretion, to examine the children of a school individually. It will thus be seen that the danger, if not of the rehabiliment of the plan of payment by results, yet of the re-introduction of rigid individual examination, is not an imaginary one. The danger arises chiefly from the demand urged in some quarters for greater accuracy in such subjects as arithmetic, spelling, composition, and reading aloud. Now this insistence on strict accuracy at every stage of the child's progress is, on hygienic and educational grounds, unsound. It ignores the fact that the intellectual progress of the individual mind, like that of the race, has ever been from the vague to the definite, from the general to the particular. It takes no cognizance of the fact that the best and most enduring results of school training are seen after the child has left school and is beyond the ken of the inspector. It so concentrates the mind of the inspector on the work of estimating tangible results, that he is of necessity unable to perform his true function, that of studying and criticising methods of teaching. Yet good methods are bound to produce genuinely good and lasting results, whereas specious results may be obtained by radically unsound methods.

Biologists have shown the close analogy between the evolution of the race, and the development of the individual. Untold ages intervened between the primitive inventions of the stone age and the invention of modern implements of precision, between the crude sketches of the cave-dweller and the artistic creations of our own times. The individual shows the same slow progress from the utter helplessness of infancy to the more or less complete control of the physical and intellectual powers in adult life. The infant's activity is first manifested by aimless stretching of the limbs, then by fruitless attempts to direct the hands towards objects he wishes to grasp. Even after he can so co-ordinate his movements as to succeed in grasping any bulky object, he is utterly unable to pick up a small object, such as a pin, with the finger and thumb. Thus the large muscles of the trunk and limbs come first under control, the smaller muscles, involving more complicated co-ordinations, much later. Even in adult life, it is only by specialising, that a man can attain to the highest perfection in the manipulation of any given set of muscles. The violinist, the pianist, the painter, the wood carver, must each undergo a prolonged special training, before he can attain that delicacy of touch, and deftness of movement, abso-

lutely essential to success in his particular art. Again, before the hand can become the obedient servant of the eye, not only must the hand acquire the power of executing, but the eye the power of seeing. The latter is not, as is sometimes assumed by teachers, examiners, and others, as perfect in the child as in the adult. It is the outcome of a long unconscious course of training. The appreciation of outwardness or distance, formerly supposed to be innate, has long been known to be the slowly-developed product of muscular sensations, *i.e.*, sensations arising from the muscles controlling locomotion, and those concerned in the movement and optical adjustments of the eye. I have found that boys of twelve and thirteen, when first set to draw from the cast, are unable to distinguish the high and reflected lights, the half lights, and shadows, and only after some months do they acquire this power, by a combination of experiment, observation, and inference.

In all branches of school-work, therefore, the child works with imperfect instruments, with organs in process of slow development. It is clear, therefore, that the results required from a child should be in strict relation to the stage of development reached by him, and that the methods employed to produce these results should be such as will aid, and not hinder, development. Under any system, demanding the preparation of vast numbers of children of varying bodily and mental conditions for a rigid and uniform examination, these rules must of necessity be continually violated. The old style of individual examination in drawing by the South Kensington Science and Art Department furnished a good example of the futility of such a system, and of the pedagogic dodges necessary to meet its requirements. In order to produce rapid results pleasing to the eye, the child in the infant school was first taught to draw on paper ruled in small squares, and he executed the drawing of objects, and simple designs, by proceeding from corner to corner of the squares, or along the ruled lines, by means of a pencil or coloured crayon, which the tender fingers of the child were unfitted to use. Thus, in order to produce spuriously pleasing results, the practice of free flowing movement was checked, the flexibility of the delicate muscles of the hand was gradually destroyed, and the eyes of the children seriously injured.

The subsequent stage in the drawing instruction was equally irrational. In order to meet the Government requirements in respect to proportion, symmetry, balance and line, the child, after elaborate measurements with the pencil, constructed a complete scaffolding of guiding lines. He next sketched in the drawing by a series of short jerky lines, varying the process by frequent erasures. Finally, after almost obliterating the

drawing thus made, by means of india-rubber, he concealed the original by a fine, continuous outline drawn with a sharp pencil. The finished product was cunningly deceptive, and agreeable to the eye, but child, teacher and examiner were equally duped, for the pupil clearly did not learn to draw; a natural consequence of a demand for premature results. Had similar drawings, of a larger size, been executed with chalk on a blackboard, by sweeping movements of the arm, the productions might have been less pleasing to the eye, and much more out of proportion, but they would have been a truthful expression of the child's powers of execution. The pupil would gradually have acquired the power of drawing, and the finished results would have appeared after many days.

Government Departments and examiners have not been alone in the demand for ripened fruit before the natural period of fruition. Business men, and members of School Boards, have often complained that boys, on leaving school, cannot write a free, flowing hand. Now this latter accomplishment, like the ability to play difficult music at sight, involves automatic and unconscious movements, which can only be acquired by many hours daily practice, extending over considerable periods. Not only do the exigencies of the school time-table forbid this amount of daily writing exercise, but such prolonged holding of the pen would cramp the tender, undeveloped muscles of the child's fingers, and thus ruin the most useful and versatile instrument the child possesses. The schoolboy hand is laboured and conscious, because, from a physiological necessity, the movements of the fingers in writing are, at this stage, laboured and conscious. The current business hand can only be acquired by specialising at the office desk, after the muscular control has reached such a stage as to warrant such specialising.

But of all school subjects arithmetic offered the most fertile field to the sticklers for accuracy, under the individual examination method. A district inspectorial staff of from four to six members, responsible for the annual examination of from 50,000 to 100,000 children, could mark examination papers in this subject with almost lightning rapidity, and express the results in figures with the utmost accuracy. Such results however, as proofs of intellectual training, were delusive. To secure the required mechanical accuracy, the pupils were drilled in the manipulation of meaningless symbols, leaving practically no time for instruction in the intelligent application of principles. Arithmetic is defined as the science of numbers, but in teaching children it would be better to define it as the science of *concrete* numbers. All such numbers relating to length, area, volume, weight, and force are notions derived from bodily sensations,

and these should form the basis of arithmetical instruction. Various weights should be lifted and carried, measures of volume should be practically used for estimating quantities of sand or water, lengths, and areas, determined by the foot rule, and tape-line, or by pacing, and money transactions gone through with imitation coins. Such methods, however, do not lend themselves to a system of individual examination, although they are essential to accurate conceptions of the subject matter dealt with in arithmetical operations.

A system of individual examination, for the purpose of testing accuracy, is educationally unsound for other reasons. It necessitates the fixing of an artificial standard in each subject, and competition between school and school will compel the teachers to endeavour to bring each child up to that standard. This would run directly counter to the fact, that amongst the children in a class, no matter how careful the classification, there will always be an almost infinite variety of natural endowment. In a large school of 600 children, after consultation with the class teachers, it was found that 22 per cent. were exceptionally bright intelligent children, 58 per cent. were of average ability, and 20 per cent. were naturally dull and slow. This classification applies to all-round attainment. Taking a particular subject, it was found, that of the 97 children chosen by the Manual Instructor, as the pick of the school in his special work, 25 per cent. were, in the opinion of the class teachers, dull, and unintelligent in ordinary school subjects. To secure all-round accuracy in the case of such children, the methods employed under the bad old system would certainly be adopted, with disastrous consequences to the health of the children. What were those methods? Backward children were frequently kept in, after the ordinary school hours; intense concentration of mind, which should result from intrinsic interest in the subject studied, was secured by external compulsion; and work in a distasteful subject was prolonged, after the point of mental exhaustion. Intelligent but nervous children suffered from mental strain, due to excessive anxiety to pass the examination, and scores of teachers broke down from worry, and tension of mind. The system of payment by results was abolished, owing to the clamorous protests of the teachers, who were co-sufferers with the children, and to the condemnation of the system by medical men, who saw too much evidence of over-pressure in their daily practice. It is earnestly to be hoped that the united efforts of these two professions may be sufficient to stifle any effort to re-establish so injurious, unscientific, and uneducational a system.

(*For discussion on this paper see page* 792.)

THE TEACHING OF HYGIENE.

By Miss S. L. BESZANT.

THE teaching of hygiene, or, as it is generally called, domestic economy, in elementary schools, has considerably improved since the abolition of payment by results. In those bad old days domestic economy was called a specific subject, a bare syllabus of work was arranged in the code, and a grant was paid on individual passes. The pass usually consisted of ability to write answers on all kinds of questions, some of which were very remote from the subject. As a result, children were supplied with small, cheap publications on domestic economy; the teacher used them as a kind of reading book, and supplemented them by cramming certain facts into the girls. This so-called teaching of hygiene caused the subject to be looked upon with contempt by scientific men and women, and consequently inspectors, and especially those of schools of science, have discouraged the teaching of the subject. They admit that it has a utilitarian value; but that it has an educative one and that it can afford training in accurate observation, they doubt.

It is because I have paid much attention to the teaching of hygiene and human physiology in an elementary and secondary school that I venture these few remarks. As I understand the subject, the teaching should consist of:—

I. Experimental demonstrations of scientific principles underlying domestic science.

II. Elementary human physiology taught practically.

III. An elementary knowledge of the composition of food, and more advanced instruction in hygiene.

IV. A practical acquaintance with the applied arts of cookery, cleaning, arrangement of daily work, laundry work, keeping household accounts, sick nursing, ambulance work, the care of young children, and household sewing.

I. It has been frequently urged that inasmuch as hygiene is based upon other sciences, presumably chemistry, physics, and animal physiology chiefly, it resolves itself into mechanical book work unless these subjects are taught first. Now the duration of a child's life in an elementary

school is too short to allow of the teaching of these subjects first, and yet hygiene is too important to be omitted. Clearly, therefore, some other method must be provided which will give the same necessity for accuracy and inductive reasoning as these subjects. It is possible to give simple elementary science lessons with a practical bearing upon hygiene in the standards of an elementary school. In many of the Bradford Board Schools a scheme of this nature has been successfully worked for several years. The following are outlines of the science taught:—

Contrast of solids and liquids.
Change of state.
Soluble and insoluble bodies.
Evaporation.
Porous and non-porous bodies.
Density.
Effects of heat.
Construction and use of thermometer.
Transmission of heat.
Composition of air.
Temporary hard and soft water.
Food.

This work has been successfully taught for several years in Belle Vue Junior and Girls' Departments, Bradford, in Standards I. to VI. The following method has been adopted:—

1. The teacher has exhibited and allowed the children to handle and examine the objects to be studied, or by means of experiments has shown the phenomena which he has wished the children to notice.

2. The scholars have then been encouraged to describe in their own words, and as minutely as possible, what they have seen, carefully distinguishing between essential and non-essential points.

3. The children have then been led to make simple inferences from the facts observed, such inferences being confirmed or disproved by further experiments until they have arrived at the comprehension of some general truth. The apparatus required is simple and inexpensive. An ordinary class-room supplied with trestle-table, rubber tubing connected with gas pendant, water, etc., is suitable for teaching purposes. In the upper standards a brief summary is written after the lessons.

In small mixed schools where boys and girls are taught together, a scheme of elementary hygiene would be as suitable for boys as girls, the applications being extended further to the necessity for labour-saving devices in the house, etc.

II. *Elementary physiology taught practically.*—This is an absolute necessity for a thorough grasp of the principles of hygiene, and should be practical, as there would then be no need for the use of misleading diagrams. In an ordinary elementary school a short course of elementary physiology could be included in standards VI. or VII.

The upper part of Belle Vue Board School has been a science school (now called a secondary school) for six years. Seeing that the teaching of human physiology and hygiene had been a feature of the school previously, it was decided to experiment with the teaching of practical physiology as a suitable subject for girls in place of practical physics. Two old attic class-rooms were converted into a very satisfactory laboratory, and under the guidance of Mr. Wager, then science inspector for the district, a four years' scheme was worked out. The subject has been treated in a scientific manner: the girls experiment, observe, draw inferences, and make their own summaries. The rabbit and frog supply plenty of material, and an intelligent butcher supplements from the slaughter-houses. The laboratory has been so constructed that the necessary physics and chemistry can be taken. The subject is popular with the girls, and no squeamishness or hysteria is shown at the sight of blood, or of a simple dissection. No text books are used by the scholars, but good books for reference have been supplied to the teachers. I beg to emphasize here the suitability of practical physiology and hygiene for girls in secondary schools.

III. The physiological syllabus is supplemented by more detailed and advanced hygiene treated experimentally in the advanced part of the science school. The subjects of food and adulteration, water-supply, the dwelling, including soils and the construction of foundations, sanitary fittings, ventilation, heating, and personal hygiene are dealt with. Visits are paid to buildings in course of erection, &c.

IV. The revised instructions to inspectors of elementary schools state that "It is not intended that this teaching (practical housewifery) should resolve itself into a class for training children for domestic service, but it is intended to be a course of instruction to fit them on leaving school for the various household duties which devolve more or less upon all women." Hence the need for scientific training to accompany or precede the practical manual work. The teaching of cookery, for example, to girls does not mean restriction to the mere learning of recipes and cooking by rule of thumb. The cookery scheme should include the cost and value of the food materials used, cleaning, setting and decorating the table, and waiting.

A few simple lessons on cleaning, laying, and lighting a fire, the

structure and mode of action of a gas oven, and cleaning flues, with simple experiments illustrating the scientific principles underlying such appliances and operations, should likewise be given.

The preparation of vegetable and animal food and beverages is taught according to the same plan, a Bunsen burner and a few test tubes affording sufficient apparatus to illustrate the scientific principles. Each day's cooking lesson in the Bradford schools includes the cooking of animal food, vegetables, and one sweet, so that the cookery does not consist of the making of cakes and toffy.

The teaching of practical cookery has been much appreciated by parents, who have frequently testified to the benefit they have derived from the instruction given. The Bradford School Board are now making preparations for the teaching of practical housewifery in a small house attached to a new school in Green Lane; this, together with laundry and cookery at the same centre, will be in operation during the visit of the Congress to Bradford. Members will be welcomed at the centre as well as at Belle Vue School.

Under the new arrangement for practical work, it is probable that girls in standards V. and VI. from four or five schools will attend the Green Lane Domestic Training School in rotation, one half day per week, and a two years' course to include laundry, cookery, and housewifery will be followed. Where there is a standard VII. I should advise instruction in more advanced household management, household sewing, the use of the sewing machine, and simple dress-cutting and making.

For several years, instruction in ambulance work and sick nursing has been given by medical men and qualified nurses in the Board's evening schools.

In order that the teaching of hygiene in schools may be a success, there must be:—

1. Sympathy between parents and teachers.

2. Sympathy between the teachers in the day schools, and the teachers of practical work.

3. A training in practical elementary science, practical physiology and hygiene in all training colleges for teachers.

There must necessarily be expense, but if the results are an improvement in the general health, happiness, and moral tone of the community, a love for home life, and a lowering in the death-rate of young children, the money will have been well spent.

(*This discussion applies also to the papers by* Dr. H. Meredith Richards *and* Mr. R. Lishman.)

Mr. A. F. Somerville (Wells) said that, as representing a county education authority, and also as chairman of a county sanitary committee, he wished to say how very much he appreciated the papers read. He wished that some resolution could have been passed calling the attention of county authorities to the question of hygiene, because one saw that there was a tendency, as had been pointed out by Mr. Lishman, to re-introduce over-pressure. In the country, where they had to deal with boys and girls not so sharp as those in the towns, the curriculum set for the children often seemed absurd. The other day two girls, one the daughter of a labourer in his garden and the other the daughter of a gardener, were asked to describe a udometer. He himself did not know what a udometer was at that time. Shortly after at the annual meeting of the school he was asked to move a vote of thanks to the Bishop, who was presiding. The master of the school, in a very excellent speech, had said that the object of education was to teach children to think rather than to cram them with details. He (Mr. Somerville), in moving the vote of thanks, mentioned what had been expected of the girls, and, turning to the Bishop, said "Of course, my lord, you know what a udometer is?" "Never heard of one!" was the reply. There was not a single person in the school except the headmaster, and perhaps one or two of the teachers, who knew what the word meant. It was, he believed, an instrument for ascertaining the amount of oxygen in the air. He thought what was wanted in schools was a little more practical teaching. They wanted a wider basis and a freer hand given to county authorities. The question of hygiene was absolutely necessary, and although they all could not incur the expense of having medical officers for their schools, they could at least train the staff of the school to pay more attention to the health and to the physical as well as to the mental capacity of the scholars.

Councillor Kennedy (Southport) said that he spoke as a member of an education authority with unlimited responsibility and limited authority. The paper that had appealed most to him was the one by Dr. Richards. It was always a pleasure to members of councils to be told what were their duties, and he noticed that Dr. Richards pointed out three. The first, he thought, was very good counsel. There were certain non-notifiable diseases, and for notification of these they were dependent upon voluntary action. He had expected some recommendation with regard to these infectious diseases. The average working class mother took the measles and the whooping-cough as a matter of course. In Southport they had made these, and also the chicken-pox, compulsorily notifiable, and they had had good results. He would like to have an expression of opinion from Dr. Richards as to whether in his opinion notification of these diseases ought not to be compulsory as well as of the others.

Dr. Bronner (Bradford) said that he thought Miss Beszant's paper was a very important one. If her ideas were carried out they would have a beneficial effect upon the married life, especially of the poor. Most girls had, as a rule, no idea of household matters before marriage, and often made their homes uncomfortable and unhappy. Of course, the so-called clever children were not always the most intelligent. They would very often find that a boy who was at the top of the class at school did not do well in after life, and if they read the history of geniuses they would find that they were often looked upon as dunces at school. There was a mistaken idea that schools were made for the clever children. Schools were made for the large number. He agreed with the remark Mr. Lishman made that the best masters ought to be reserved for the backward children. It would therefore be very unfair if the abilities of the master were judged by the successes of his children. A clever child ought to be kept back. The system of cramming was fatal. The chief thing was to teach the children to think and how to learn, because, as a matter of fact, what they did learn at school was not very much. They learnt a great deal more after they left school.

Mr. W. Claridge (Chairman, Bradford School Board) said that it had been suggested that they should try and get some practical results from their Conference. Dr. Richards suggested that children should not be compelled to attend school when suffering from or associated with disease. Payment by the Government, however, depended upon the attendance, and the consequence was that there was a bribe to attend. Cases of illness had been provided for by Article 101 in the old code. If infection broke out the teachers did not try to force the children into the school, but by marking the child's name, as allowed by that regulation, they got the benefit of the attendance grant. He thought that they should recognise the need of having Article 101 put back into the code. Coming to another practical point, he thought that they might do a great deal of good in sending an emphatic protest against the individual examination of children. He was sure that the case only required to be stated in order to be recognised. Another practical point in Miss Beszant's paper was that the teachers who were present, and who heard perhaps for the first time the things she had said, should try and introduce some of the advantages she had dealt with. The Bradford School Board were asking Miss Beszant to hold a class on Fridays and Saturdays, so that every teacher would have an opportunity of attending them during the coming winter. The Bradford School Board was very alive to the need for development on these lines, and its movement in that direction was very largely due to Miss Macmillan's influence. Now the work had been taken up earnestly by the School Board, and they were opening classes in Green Lane. With regard to Dr. Richards' paper he would like to say that it would be better if that paper had been devoted to the secondary schools of the country. His own experience was that the requirements of that paper had been more

or less met in elementary education, but with regard to secondary education they most decidedly had not been met. They would find secondary schools where the children were packed more or less like herrings in a box. The paper on hygiene, he thought, was of such immense value that it should be circulated broadcast. It was the best paper that he had listened to on that subject.

Mr. Thomas Garbutt (Clerk to the Bradford School Board) said that the question of making sure that children were physically fit before they began to attend school was, he thought, well met in the larger towns. With regard to notifiable diseases, his feeling was that if measles were added to the number it would be a step in the right direction. He was strongly of opinion that the epidemics of measles could easily be stamped out if the local authorities would pay the usual fees for notification and discharge. Miss Beszant had told them how far they could go in training the teachers, and they should see that the teacher was taught to detect disease. He, as clerk of a school board, had a strong prejudice against divided school medical authorities, *i.e.*, the division of a district under separate local practitioners. Let there be one medical man specially appointed, and responsible for the whole of the schools in the district and give him such help as he may need. A proposal had been made to have a daily visit from the doctor, but he thought that would have the effect of causing a species of panic. A daily visit of a medical man or even a nursing sister would be very injurious. It would operate prejudicially on the discipline of the school, and would make the parents themselves think that attendance at the schools was injurious. He never heard of ringworm being sufficiently prevalent in any school to require the formation of a special class. If children suffering from ringworm could be isolated and detained in all cases where they were neglected at home, speedy cures might be effected. In Bradford they had had one or two schools where it had been necessary to examine the children's heads, and he had been informed by parents on many occasions that the School Board appeared to have a very poor opinion of the parents of Bradford. No child could be admitted to a special school unless certified as suitable by the head teacher and by a medical man, and afterwards examined in the presence of an inspector of the Board of Education. As regards the special classes in Bradford, when the teacher of an ordinary school reported a case, the doctor visited that case and reported to a committee; and the committee invited the parent to attend with the child at a meeting of the committee. The greatest moral suasion had to be brought to bear upon the parents to make them think that the child was not quite bright. He approved of the suggestion that the class rooms should be as bright as possible. In Bradford they were doing their best in this direction. With regard to Article 101*, the Bradford School Board had petitioned strongly in favour of its retention, but had so far only received a mere acknowledgment. He called attention to the last paragraph of Mr. Lishman's paper, which he thought should be emphasised.

MRS. KIRK (Bradford) said that she thought that the teaching of hygiene should begin in the lowest class of the infant school, the baby class, not by means of rules, but by training the child in good habits. She that thought if there could be an improvement in the standard of work expected from infant teachers it would be a great assistance.

MR. GILL (Bradford) said he thought that they need not form classes of children suffering from ringworm, which was on the decrease in Bradford. Local authorities, he thought, should do something with regard to children coming from infected homes. If the authorities would issue circulars asking the parents to keep such children at home, it would help. With regard to Miss Beszant's paper he was afraid she had not come down to his level; at any rate the papers read would show that teachers were fully alive to the needs of the time. He did not think that any doctor was a bugbear in coming into school. They in Bradford had been heartily glad to see Dr. Kerr, and now they were glad to see his successor. As regarded the Bradford School Board, he did not think that there were many suggestions thrown out that morning that were not being put into practice in the Bradford schools. He regretted that the last speaker but one seemed to breathe a suggestion of mistrust of teachers; he did not like the tone of the remarks at all. There were teachers to be found who would teach their subjects in a competent fashion. Individual examinations were looming in the air, and the teachers dreaded them and regretted it for the children's sake.

DR. CROWLEY (Bradford) said that he thought that the teaching of hygiene should be carried out much more fully than at present. One could not help seeing the lack of the knowledge, even in Bradford, where considerable attention was paid to the subject in the higher grade schools. One of the teachers actually told him that he did not like to open the windows because the children got the mumps! Occasionally he asked of the pupil teachers the question: "How many times does your heart beat in a minute?" and "How many times do you breathe in a minute?" and he frequently got an incorrect answer. The teaching of hygiene in the ordinary schools could only be done in the course of the ordinary curriculum. In the past medical officers of health had been men who had not had the benefit of practical school work, and he ventured to say that their recommendations must sometimes be received with caution. In Bradford, though the establishment of special classes for ringworm children was certainly not necessary, yet he thought they could limit the number of cases even more than at present, by appointing one or two nurses to visit among the schools. They had about fifty children absent on account of ringworm, and about fifty more on account of the dirty state of their heads.

THE PRESIDENT (Dr. J. Kerr) said that several important points had been brought forth. It appeared to him that the necessity for hygienic training in

schools had been well emphasised. In the infant department proper habits could be shaped. At present he was considering whether or not they should have ringworm schools. As Dr. Crowley had said, there were not many cases of ringworm in Bradford but there were parts where it was very serious. Then the question of Article 101* was almost one of high politics. It was so important that, although no resolution had been made, he proposed reading one from the chair and sending it forward.

Miss Beszant, in replying on the discussion, said that the object she had in reading the paper was not to teach teachers, but that she thought it her duty to show the people of Bradford what the Bradford School Board had done in the way of teaching hygiene. It was not always the Board of Education that had failed. It was often a question of economy. In many secondary mixed classes it was economical to employ a man to teach physics and chemistry rather than physics to the boys and hygiene to the girls. Physiology and hygiene had been very badly taught, and inspectors had been afraid to advise that they should be taught to girls. An inspector had once said to her, "You cannot teach physiology and hygiene and make it an educational subject like physics and chemistry." She replied "if you will allow me to experiment I will prove to you that it can be done." She referred to Mr. Wager, H.M.I. of Secondary Schools, and he had helped her, with the result that it had been pronounced by the inspectors to be satisfactory. With regard to the formation of habits she found it satisfactory to make scholars responsible for the opening of windows and for the tidiness of the class rooms. She would like to emphasise the fact that the habits of the teachers could be improved, especially in regard to the stopping in the class room to dinner instead of getting out into the fresh air. They stopped often enough to gossip. She would also like to emphasise the fact that the head teachers should teach the others not to drink so much tea as they did. In her paper she especially wanted not to talk from the standpoint of the secondary school. In the elementary part of their school they taught elementary science applicable to board schools. There was no elaborate apparatus necessary, so that there was no necessity for the teacher to postpone making a start.

Mr. Lishman said that it was a well known fact that the majority of the Oxford and Cambridge senior wranglers never distinguished themselves in after life. With the abolition of payment by results the elementary teachers had been able to extend the curriculum of their schools. He had no belief in the dictum that they ought to teach a little and teach it well. At present a chance was given to every boy to distinguish himself in the branch for which he was best fitted, but under the old plan many boys had no chance of distinguishing themselves. Many of the so-called duffers were incipient engineers or inventors. He believed, therefore, in a wide curriculum. In order to really train the children they wanted to be careful in the appointment of teachers. Having

done that, the inspectors ought to confine themselves entirely to criticism of methods of teaching and not to examination of results. If the methods were good the results would be good, but if they were bad they could only have bad results. They could, however, get speciously good results from bad methods. In his paper he mentioned as an example of this how in drawing, under the old scheme of South Kensington, utterly vicious methods were used.

Dr. Richards (Croydon) said that he was pleased to hear from Dr. Kennedy that in Southport the compulsory notification of measles had, so far, worked satisfactorily, but there were objections to the universal application of that system. School notifications gave medical officers an opportunity of visiting the parents and educating them in the treatment of the so-called minor diseases. The objections raised to the formation of special classes for ringworm had been answered by the President. Circumstances differed in various parts of the country. In the neighbourhood of London ringworm was a serious matter, as cases were numerous and entailed absence from school for from three to six months. He assured Mr. Garbutt that his strictures on insanitary schools did not apply to the schools provided by progressive authorities like Bradford. It was a fact, however, that in various parts of the country schools with grave sanitary defects were far too common. The question of dirty heads was a disagreeable one. Hospital experience showed how widespread the trouble was. At present only the most obvious cases were excluded from school. More stringent regulations and greater care were necessary in dealing with these cases. He was extremely interested in Miss Beszant's paper, but he did not think that hygiene could be taught in elementary schools in the thorough manner suggested. He feared teachers would find few children under thirteen years of age sufficiently developed to benefit from such instruction. He thought, therefore, that school hygiene should be taught in the concrete manner suggested in his paper. To enable this to be done, it was of course essential that every teacher should be thoroughly grounded in hygiene.

The President (Dr. J. Kerr) then moved that this Conference of The Sanitary Institute on the Hygiene of School Life suggests the desirability of re-inserting the code regulations for payment of grant under Section 101* in cases where absence is due to epidemic disease, as this has been a sanitary influence of great practical use in the past.

Mr. Claridge seconded the resolution, and it was carried.

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 855.

CHILDREN AND THEIR EYESIGHT.

By SYDNEY STEPHENSON, M.B., F.R.C.S.E.

Hon. Secretary of the Ophthalmological Society; Ophthalmic Surgeon to the Evelina Hospital, etc.

THAT the opinions of medical men differ upon most points is proverbial. But with regard to the steps that should be taken for the preservation of scholars' eyesight there is now a practical unanimity amongst those whose experience qualifies them to speak with any authority. Although there may be some differences as to details, yet there is none when it comes to the great principles underlying the whole subject of what is generally called school hygiene. I purpose to explain briefly what these principles are, and how they can be carried out with the least possible interference with the routine work of education. So far from being antagonistic, education and hygiene should walk hand in hand.

In the first place, a few words of explanation must be given as to the defects of sight met with amongst children of school age.

The natural eye is so constructed that parallel rays of light (that is, practically all rays from an object distant more than sixteen feet away) are focussed upon the sensitive retina of the eye without any call upon the function of accommodation. This condition is known as emmetropia.

There are two departures from the normal, both of which are far commoner in children than the normal itself, namely, long sight or hypermetropia, and short sight or myopia. Either condition may be complicated with astigmatism, which is generally due to a faulty curvature of the transparent front, or cornea of the eye.

The long-sighted eye may be best described as too short from back to front, so that rays of light focus behind the retina, and a blurred image results. The child gets clear vision of objects only by instinctively using his accommodation, and in that way increasing the convexity and strength of the crystalline lens, so as to bring rays of light to a focus on the

retina. Long sight is congenital, and is not in any sense the result of unfavourable school surroundings. It is extremely frequent in children (combined or not with astigmatism), and often causes much distress, which may be shown in various ways, as by aching eyes, headache, reddened eyelids, and squint. Its slighter degrees cause, as a rule, little interference with sight, and can be discovered only when the eyes are examined by an expert. Yet these minor grades, especially when they occur in a highly-strung and nervous child, not infrequently give rise to weary and aching eyes, and to an inability to continue school work for long together. Exceptionally, they appear to render such children downright ill.

Hypermetropia may be relieved by convex glasses, the strength of which must be exactly proportionate to the degree of the defect. The effect of such glasses is to bring the parallel rays of light to a focus on the retina without any strain on the ciliary muscle, the muscle of accommodation. Although the condition, as already stated, is in no sense one of school production, yet the good or bad surroundings as to light, print, posture, etc., readily aggravate or relieve the symptoms of hypermetropia.

Short sight, or myopia, on the other hand, is in many cases the direct outcome of the school environment. In this condition the eye is too long from before backwards, so that parallel rays of light focus short of the retina, and blurred images result. The myopic eye is not seldom a diseased eye, and under any circumstances the condition is one that calls for careful management during school-life.

It has been proved, mainly by the elaborate statistics collected by Professor Herman Cohn, of Breslau, that myopia is essentially a disease of school manufacture. Its percentage varies directly with the form-class of the scholar, and with the educational and social grade of the school. In other words, the more exacting the educational call upon the eyes, the higher becomes the percentage of the scholars with myopia. Further, there is the important fact that the average degree of myopia bears a relationship to the percentage-incidence of myopia; that is to say, the degree is greater when the percentage is large, and contrariwise.

In order to furnish some idea of the incidence of myopia in Germany, whence Cohn's figures were mainly drawn, it may be stated that the percentage in the village schools was 1·4, in the middle schools 10·3, in the gymnasia 26·2, and in the universities no less than 59.

Myopia is much less frequent in England than in some of the continental countries, especially Germany and Austria-Hungary. According to my personal investigations, made under conditions that practically

precluded any error of observation, it does not exist in more than 7 per cent. of the children living in Poor-law schools. The figures dealt with are large enough, amounting as they do to upwards of 5,000 eyes, to preclude any serious statistical errors. The ages of the children ranged from 15 months to 18 years. Amongst the male eyes the percentage of myopia was 5·65, while amongst the female eyes it was 8·04. Almost all the remaining 5,351 eyes were long-sighted, with or without astigmatism. It is highly probable that the incidence of myopia in the ordinary Board or Church school is no larger than that in the Poor-law school. For example, in the year 1880 Mr. Priestley Smith examined 1,636 children (7 to 13 years of age) in the Birmingham Board Schools, and found myopia in 5·3 per cent. Six years later, Mr. W. T. Jackman investigated the eyes of 456 village school children, and found myopia to be present in only 2·17 per cent. In 1896 Mr. R. B. Carter declared that "the enormously preponderating visual state was one of hypermetropia" amongst 8,125 children in 25 London elementary schools. In the report recently issued by Dr. James Kerr, medical officer to the London School Board, what is called "very bad sight" (one-sixth of the normal or worse) was found to show a regular increase from 1·5 per cent. in standard I. to 3·5 per cent. in standard ex-VII. Included in this percentage are instances of sight defective from causes other than myopia as, for example, from spasm of accommodation, injuries, and actual disease of the eyes. It is reasonable to think, however, that myopia was the chief factor, a supposition substantiated by the fact that the percentage augmented the higher the standard investigated.

In brief, we shall not err greatly if we assume that 5 per cent. of the children attending the communal schools of this country suffer from myopia. The case is different as regards schools of higher social standing, where greater demands are naturally made upon the eyes. In the few such schools that I have had the opportunity of examining, myopia was found in 10 to 15 per cent. of the scholars.

Personally, I should be one of the first to deprecate any alarmist statements as to the prevalence of myopia in English schools. At the same time, I feel convinced that the relative percentage of myopia in schools of the same social standing must be accepted as to the touchstone of the good or bad hygienic condition, especially as regards the lighting of the class-rooms, and the seating, position, and work of the scholars.

One point I desire to render plain is this, that, according to our present information, long sight in English schools is twenty times more frequent than the reverse condition of short sight. The relative infre-

quency of myopia, however, is no argument against rendering British schools as satisfactory as may be from the hygienic standpoint. Had such precautions been adopted long ago it is likely that we should not now have to record the painful fact that upwards of one half of the undergraduates in the German Universities are short-sighted!

From what has been said it will therefore be apparent that the question of good school arrangements is bound up not only with the actual manufacture of myopia, but also, as regards England, with aggravation of the symptoms that in many cases accompany long sight and astigmatism. It is the bounden duty, therefore, of those responsible for the education of children, whether in Board or other schools, to see that the arrangements reach a good standard of modern hygiene.

The measures to be adopted in dealing with children's eyesight may be described under three heads, namely, those of prevention, detection, and remedy. These may be considered one by one.

(I.) *Measures of Prevention.*—As regards the internal arrangements of rooms where scholars work, the following points call for the most careful attention:—

(*a*) Lighting, natural and artificial.
(*b*) Seats and Desks, and the position of the scholar at his work.
(*c*) Slates, Maps, the print and paper of books, etc.
(*d*) The kinds of work, intervals for recreation, holidays, and so forth.

(*a*) The connection between myopia and deficient illumination has been clearly proved by Professor Cohn, who found that myopia varied from 1·8 per cent. in well-lighted to 15 per cent. in badly-lighted rooms, other conditions being the same. Indeed, the good illumination of a class-room is so vital a point that too much care can scarcely be devoted to its attainment, and in this connection we have to consider both the amount and the direction of the light.

It may be laid down as an axiom that (provided there is no dazzling) the amount of light cannot well be too great. For directly measuring the degree of light, there are several scientific instruments known as photometers, but these are, unfortunately, too complicated for everyday use. A simple, cheap, and efficient photometer is still a *desideratum*, but until such an instrument is at our disposal, we may adopt one or two simple plans for finding out whether the light in a given room is or is not ample for educational purposes. First, we may seat ourselves in the scholar's place, and ascertain whether or not we can from thence see a portion of the sky. In the former event we assume that the seat is well-enough

lighted, whereas in the latter we may be confident that such is not the case. A second rough-and-ready test is to find out whether the child seated in his habitual place can read diamond type at a distance of sixteen inches from his eyes. In a good light and with normal eyes this he should assuredly be able to do.

The amount of daylight in any given room depends of course upon the windows; the ratio they bear to the floor-space, as well as their number, size, and distribution. They should be of such dimensions that their surface is equal to at least one-fifth of the floor-space of the class-room, or, in other words, that there should be one square foot of glass for every five square feet of floor-space. Cohn in Germany found that rooms built in accordance with this principle were, other things being equal, sufficiently well-lighted. In England, where there is less diffused daylight than in Germany, the ratio named should, I think, be accepted as the irreducible minimum. Yet in this country I have inspected many rooms (built expressly for school purposes) where the ratio between windows and floor has been as low as 1:8, 1:10, or even 1:15. The continued use of such rooms for school purposes constitutes, in my opinion, little less than a wanton outrage upon the children's eyesight. It may be urged that there is a difficulty in warming a room with a high ratio of glass to floor-space. This is undoubtedly true. It is, however, no argument against providing a proper amount of glass, and, if necessary, plenty of light must be purchased by increasing the means for providing artificial warmth.

The glass must be effective, it must not be overshadowed by neighbouring buildings, or rendered more or less useless by trees, covered ways, and so forth. Moreover, the windows should be glazed with plate glass, and not with cathedral or muffled glass. They should not be broken up by many sash-bars, the artistic effects of which, it is to be feared, sometimes makes architects a little oblivious to their light-stopping powers. Windows should extend to as near the ceiling as may be, both in the interests of light and of ventilation. On the other hand, their lower sills should never come lower than the heads of the children when seated at their work, a distance that may be approximately stated at 36 inches above the floor. Any violation of this rule implies a needless dazzling of the scholars' eyes by light reaching the latter from below. Nevertheless, it is a mistake now and then made in school architecture to place the windows high up in the wall of the room, as such give any room a gloomy and forbidding aspect, bad alike for teachers and for taught.

As to the position of the windows, there is now a consensus of opinion that for the most part they should be placed to the left of the scholars,

so that no shadows may be thrown upon the writing. It has been proposed to arrange them on one side of the room only. In my view, that is a mistake, as by that plan the advantages of cross-ventilation would be sacrificed. A method that I have seen adopted is much better, namely, to have large windows to the left of the children and smaller ones to their right. In this way the main body of the light comes from the left, and its intensity is increased, while the opposite windows ensure that the room may be purified by a cross current of pure, outside air.

Much has been made in some quarters of the aspect of the windows. Thus, a demand has been formulated for windows facing north, on the mistaken analogy of the artist and his studio. Speaking for myself, I consider aspect a matter secondary to some other points, particularly the ratio between the windows and the floor-space. Some simple means, however, such as a sliding blind, must be provided for the purpose of keeping direct sunlight away from the scholars' eyes.

It goes without saying, that the walls of a room are not without influence upon the illumination. They should be smoothly finished and painted of a light colour, although a very shiny surface is to be carefully avoided.

The artificial lighting of class-rooms is a more difficult problem. The easiest solution is to do as little work as possible by such means. Now and then this may be arranged by the exercise of a little thought. For example, during the winter months work might be begun an hour or two earlier than usual, so as to minimise the use of artificial light as much as possible. The latter, however, cannot be avoided altogether, especially in good-class boarding schools, where evening preparation forms an integral part of the curriculum. Electricity gives the best light, since it is perfectly steady, and the electric glow-lamps do not foul the air with the products of combustion as do naked gas-jets. The glow-lamps should be freely distributed about the room and arranged with particular reference to the scholars' desks. They should not be clustered in an electrolier. If an arc-lamp were available, it would be a simple matter to throw its light upon the ceiling by means of mirrors, so that the room might be flooded by bright and well diffused light, without the incandescent carbons being visible by any scholar. The worst and commonest of all lights is the naked gas-burner, exposed to every current of air, flickering, polluting the atmosphere, and, at best, giving a light trying even to healthy eyes. Failing electricity, perhaps the best plan is to provide the room with a number of incandescent gas mantles, arranged so that the light shall not fall directly upon the scholars' faces.

(*b*) A desk, of good type, should fulfil several requisites, of which the

following are the more important: it should accommodate two children only,* be graded according to the size of the scholar, and should afford plenty of elbow-room, it should be provided with a support both for the back and also for the feet, the vertical height of the seat should be equal to the length of the scholar's leg below the knee; it should be wide enough to be comfortable, and hinged to swing back, so as to allow the child to stand in his place. In order to prevent stooping over work, the top of the desk should project somewhat over the front edge of the seat, and should be made in two sections, so that it may be folded over when work is finished, or when a child stands in his place. For writing, it should have a slope of ten degrees or so. The desk should have a depression for an ink-pot, a groove for pens and pencils, and a shelf for books. There are numerous desks upon the market that answer all the foregoing requirements. The great object of having such desks is to prevent the scholar from stooping over his work, a habit deleterious both to good eyesight and to straight spines. Any tendency in that direction should be persistently corrected by the teachers, who seem seldom to understand that the book, in a child with normal eyes, should never be held closer than twelve inches from the face.

(*c*) All books for children, above all for the junior classes, should be printed in large, clear type, upon good paper. Those provided with marginal notes or references in tiny type should be unconditionally rejected; many of the dictionaries in common use are most objectionable. A paper with a glossy surface should be avoided, and care should be taken to see that the lines are not too long, that the letters are well spaced, and that the type is properly leaded. Personally, I think there is much to be said in favour of double columns of print. From an ophthalmic point of view, the reading of German and Greek characters must be altogether condemned. Blackboards, which, unless quite new and of good quality, are often very trying to the eyes, should be replaced by slabs of composition let into convenient positions in the walls of the class-room. These mural tablets must be so arranged that writing on their surfaces can be plainly seen from any part of the room. There is some little difference of opinion as to the advisability of employing the economical hand-slate for the younger children. Glass tablets are better. Two pieces of glass are ground upon one surface, and placed back to back, with a layer of black paint between them, and are then mounted in a wooden frame. A specially

* Such desks are thought by some to favour the passage of infection from one child to another. I am aware, however, of no actual evidence with regard to this view.—S. S.

prepared pencil is used in conjunction with the glass tablets. Apart from influence upon eyesight, slates seem to be a likely mode of conveying from child to child certain diseases of the mouth and throat, an objection perhaps serious enough to condemn them altogether. Maps commonly contain too much detail, and should be replaced by more legible devices. Sketch-maps, with important places only marked, are preferable. Finally, I would throw out the suggestion that all school-apparatus should be passed by competent medical authority before being issued for use.

(*d*) Certain kinds of work are objectionable from the standpoint of the children's eyes. I may instance the pernicious custom of attempting to teach needlework to infants, a practice that should be at once abolished. It is education run mad! No sight is sadder to a trained mind than to see a child of tender years poring painfully over some piece of grotesque sewing that would task the eyes, fingers, and brain of a much older scholar. The wonder is not that the child does it badly, but that she can do it at all. It is possible that the preponderance of short sight in girls as compared with boys, is owing to the needlework done by the former. The function of sight is one that develops gradually, so that it is manifestly unfair to expect the eye-work from a child of five or six years, that one would exact from a child of ten or twelve. If the so-called infants are allowed to attend school at all, a course the wisdom of which I question, they should be given only work that cannot throw any strain upon the eyes, with frequent intervals for recreation. Some of the Kindergarten work that I have seen is far too trying for the eyes of young children. In short, I agree with Dr. James Kerr's remarks in Newsholme and Pakes's "School Hygiene" (1903), when he says (page 91), that "needles, pins, pencils, and paper are all out of place in the infant school." I would like to add that, in my opinion, the infants themselves are also out of place in a school at all.

All lessons should be interrupted at short intervals for purposes of recreation, which should, whenever possible, be spent in the open air. Under no circumstances should a teacher be permitted to deprive a child of this breathing space. A moment's reflection will show us that the children most likely to be punished in this way are the stupid ones, and for them, more than for any other children, the recreation time is a paramount necessity. During fine weather, a good deal of the schooling can be carried out in the open air, more especially in country schools.

(2) *Measures of Detection.*—The steps to be taken for detecting children with abnormal eyes are as simple as they are feasible. The sight of every child should be tested on joining the school, and the result should

be entered in a separate book, or eyesight register, together with the date of the examination. The earliest age at which the tests can be made with an average child is seven years, and only an expert can determine in a younger child whether or not the eyes reach a normal standard. The testing of the children's eyesight can be carried out by any intelligent teacher, first instructed in the method by a medical man. The usual apparatus is simple and inexpensive. It consists of a set of printed letters of various sizes known as Snellen's distance types. The printed sheet is hung upon a wall at the level of the eyes and at a distance of 20 feet from the scholar. Letters of a particular size should be distinguished at this distance by a normal eye. In order to secure uniform illumination for the letters, the type should be illuminated by means of a couple of Argand burners or by a like number of electric glow-lamps. The eyes are then tested separately. For very young children, instead of letters, simpler devices may be employed, such as broken squares or circles of different sizes. The child under examination is then merely required to draw the squares or circles on a piece of paper as they appear to him, and in this way a satisfactory estimate may generally be formed as to the amount of sight he possesses.

As visual memory is strong in many children, there should be some contrivance for rapidly changing the letters, which under no circumstances should be left exposed upon the wall for the children to commit to memory. There are several simple means of doing this, and amongst them I may mention the new combination test type, suggested by Mr. Charles Wray, and made by Messrs. Down Bros., St. Thomas's Street, S.E. This an oblong cabinet, which is placed on a low table 10 feet away from the child. The distance is doubled by the aid of a mirror, so that a working distance of 20 feet is secured. The cabinet contains seven rows of holes of different sizes, and behind these test letters, mounted on revolving cubes, are placed. The combinations that may be thus obtained are practically unlimited.

The test, as described above, should be repeated once a year during the continuance of school-life, and the results recorded.

If upon the first or subsequent examinations sight be found to fall short of the normal standard, the case should be referred to the school physician, if such an official exists, or in the contrary event a printed card, calling attention to the need of skilled advice, should be posted to the child's parents. Some such plan has been adopted by the Edmonton, and, I believe, the Birmingham, School Board for several years, and by the School Board for London more recently.

(3) *Measures of Remedy.*—In my opinion, to every school or group of schools there should be attached a salaried medical man, qualified by training to detect, and to correct with suitable glasses, all errors of refraction. In the larger towns this duty might be relegated to an ophthalmic surgeon, but in country districts the duty would have to be thrown upon the shoulders of the ordinary medical man. At first, it might be difficult to obtain suitably trained officers for this work. But the supply would soon be equal to the demand, much in the same way as nowadays there is little trouble in getting medical men trained and diplomated in hygiene to fill the post of medical officer of health in rural districts. It should be part of the duty of the school physician to visit periodically the schools under his charge: to advise with respect to all questions of school hygiene; to instruct teachers how to make the first rough test of eyesight; to be consulted as to new schools, projected or building; and, finally, to him should be referred every child whose sight was thought to be defective.

There should be some plan whereby spectacles could be supplied free to poor and necessitous children.*

The sending of children with bad eyesight to opticians, whether qualified or the reverse, is a practice that is especially to be discountenanced. The eye is a part of the human body, and something more than a mere knowledge of optics is needed to cope with the manifold disorders of so delicate and complicated an organ.

Conclusion.—In conclusion, I wish to advocate one or two miscellaneous reforms. In the first place, it seems most desirable that the present cast-iron curriculum should be modified to suit exceptional children, particularly those with weak eyes or delicate general health. Is there any valid reason why a physically defective child should be placed as regards a Board school on the horns of an educational dilemma in the sense that he must either fall into line with his more capable playmates or else be left altogether on one side? Under the conditions at present existing in most Board and Public schools, the educational wind is assuredly not tempered for the shorn lamb. Next, I think that large School Boards might wisely educate all children with seriously defective eyesight in separate buildings, under teachers of a sympathetic temperamant, who would adapt the course of study for that particular class of case. Lastly, I merely re-echo the wish of many earnest school reformers, when I express the hope that

* For some years the Samaritan Fund of the North Eastern Hospital for Children, London, N.E., has given help to poor parents in buying glasses prescribed for their children in the Ophthalmic department of the Institution.

ere long a certificate of hygiene (not in its theoretical aspect only) will be required to form a part of every teacher's qualifications. When that happy result has been obtained, it will, I hope, be correlated with the possession of corresponding knowledge on the part of school inspectors and school managers.

Finally, I cannot refrain from pointing out that home surroundings have an influence for good or for bad upon the eyesight of children. The unfavourable conditions now and then present in our schools and class-rooms may be reproduced, nay accentuated, at home, and this becomes a serious matter when we recollect that the scholars of the higher day schools have much work to do at their own homes. It is, indeed, possible that the school is blamed for producing defects in sight which are attributable to the domestic surroundings. One remedy for this state of things is to reduce the amount of home study to a minimum. Another is to instruct parents with regard to the best way of preserving children's eyesight. In brief, let information replace that domestic ignorance as to the physical needs of growing children that is now, alas! the rule in many middle and upper class households.

(*For discussion on this paper, see page* 821.)

ON THE IMPORTANCE OF EXAMINING THE EYES AND EARS OF ALL SCHOOL CHILDREN, NOT ONLY OF THOSE IN THE BOARD SCHOOLS.

By ADOLPH BRONNER, M.D.

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A GREAT deal has been written in late years on the Continent on School Hygiene, on the importance of examining school children and adopting measures to ensure the best possible development of their minds and bodies. In this country we are at last waking up, and grasping the great importance of this work. Bradford was one of the first towns to have a School Board Medical Officer. We had the great fortune to secure the services of our able President, Dr. Kerr, who performed his duties so well, and published his reports and investigations so efficiently, that other towns are now following our example, and London, which always attracts the best of everything, has appointed Dr. Kerr Medical Officer to its School Board, where he has the supervision of no less than 600,000 children.

One of the most important duties Dr. Kerr has to perform is to watch over the eyes and ears of these children. He has kindly furnished me with a few details of the important work he has done during the last year in this direction. Eight medical men were appointed to examine and report on the eyes of the children. The results of their investigations have been most interesting and remarkable, especially when compared with the statistics of similar work done on the Continent. About 10 per cent. of these children (no less than 60,000) have defective eyesight; that is, they have less than one-third of normal vision. Fifty-four per cent. of the children in Standard 1, and in Standard 7 no less than 80 per cent.,

have *normal* vision. In Standard 1, 6 per cent. have bad vision (less than one-third of normal), and in Standard 7 only 8·8 per cent., a marked improvement. Very bad vision (one-sixth or less of normal) was found in 1·6 per cent. in Standard 1, and 3·5 per cent. in Standard 7; this is probably due to a slight increase in short sight. These figures are most gratifying if we compare them with the vision of continental school-children.

Cohn has collected the statistics published by a large number of German observers. He finds that in the lower classes in German schools 22 per cent. of the children are short-sighted, and in the upper classes no less than 58 per cent.; in some cases, indeed, as many as 74 per cent., a most alarming increase in bad vision. According to the report of the Royal Commission on Physical Training in Scotland, 31·5 per cent. of the children in Scotch Board Schools have bad eyesight and 42 per cent. have defective hearing.

Dr. Kerr also examined the vision in a number of precocious and of backward children of twelve years of age. He found that of the former only 18·7 per cent. had defective eyesight, whereas of the latter no less 29·6 per cent. could not see well. These figures prove conclusively that defective vision, if not attended to, retards the mental development of the children, though of course, there are other obvious reasons to be considered. I shall refer to this important fact later on. The vision of London children varies in the different schools. The worst results are found in the poorer, and in the Jewish districts. We know that myopia, or short sight, depends greatly on the shape of the head and orbit, the higher the orbit the more likely is the eye to become short-sighted. Therefore the frequency of myopia varies in the different races, and it is very prevelant in the Jewish race.

All children with defective vision in London Board Schools are supplied with a card, on which the parents are informed that the child cannot see well, and that it should be examined by a medical man. In urgent cases a red card is given. This year medical men tested the vision of the children, next year the teachers will do this, and refer defective children to the medical men appointed. The eyes are not treated or tested for glasses, but the children are sent on to the family doctor or to a hospital. This seems to me a most unsatisfactory state of things. The poorer children in all Board Schools should be examined and supplied with glasses by the authorities, and I hope that in a few years this will be done. A great deal of money is wasted in trying to teach children who cannot see or hear properly, much more than a few glasses would cost. A few shilllings spent

on spectacles would, in a great many cases, make all the difference in the world to a boy's career at school.

As yet no systematic examination of the ears of the London school-children has been made. Dr. Cheatle has examined 1,000 children of the Hanwell District School, and has kindly permitted me to make use of his investigations. The ears were normal only in 432 cases, or less than one half, a most startling and remarkable discovery. The middle ear was diseased in 518 cases. No less than 434 children had adenoids, and 231 enlarged tonsils, many of course having both enlarged tonsils and adenoids.

These figures show that a large proportion of children, in the Board Schools at least, suffer from defects of hearing and sight. How is it possible for a boy who cannot see, whose eyes ache when he reads, who cannot hear what the teacher says, to get on at school? He is most seriously handicapped, not only at school but also in after life. You will generally find that a child who cannot read well, and who takes a dislike to his lessons, suffers from some defect of vision. Instead of bullying the boy, and constantly telling him he is stupid and lazy, his parents or teachers should take the trouble to find out why he is backward. Probably they would discover that he could not see to do his lessons, and that this was the reason why he disliked school. In the good old days, and I am sorry to say often even now, it used to be the custom at most schools for each class to have a few boys attached to it who did not get on, in whom no one took any interest, who sat by themselves, and did what they liked. No one took the trouble to find out why they were backward. It was often as Dr. Kerr's statistics prove, because they could not see or hear as well as the other boys. Surely this is a most unsatisfactory state of things. I am often asked to examine the eyes and ears of boys who have been at school for years, who have never got on well there, and who have been condemned as stupid by the teacher. The parents have been advised to send them on to a farm in the Colonies, or to South Africa, or formerly to put them into the Army, because they were too stupid to go into business or enter a profession. The boys were examined and found to suffer from defective eyesight, and not to be stupid at all.

Deafness in children is generally due to adenoids or enlarged tonsils. If these are removed early the deafness disappears, if they are not it increases and becomes incurable. The child cannot breathe through the nose, keeps his mouth open, has a vacant dull expression, snores, and has a narrow undeveloped chest. I remember, not very long ago, how a mother, in a great state of excitement, brought her son to see me. She had taken him to a new school. The boy had adenoids and was deaf. The head-

master spoke a few words to the child, and then turning to the mother said, "I am afraid your boy is not quite right in his head. I am surprised you have not been told of this before. He can certainly not be admitted into this school." The boy had the adenoids removed and the deafness cured, and shortly afterwards he became a promising pupil in that very same school. Parents are very apt to overlook slight failings in their own children. They do not notice that the boy cannot see or hear so well, they ignore his complaints of headache after reading, that he cannot see the blackboard at school, etc., and they get used to his dull, vacant expression. It is the duty of the teachers to notice these things. The sight and hearing of each boy should be tested on admission to the school, and again every year as long as he remains there. This can very easily be done by the teachers. Test-types, with different sized letters, should be hung on the wall at a certain distance, and the boy told to write down all the letters he can read. If he cannot see them all, or if he cannot read small print at 12–15 inches, this should be at once reported to the parents, and the boy not allowed to return to school until he has been medically examined and treated. An infectious disease of the inner surface of the eyelids, *follicular conjunctivitis*, is often very prevalent at boarding schools. The eyes are red, the child blinks and cannot bear the light, the lids are puffy and swollen, and often gummed together in the morning. During school holidays I always see children who suffer from this disease; they tell you that many of the other boys have the same complaint, but that no notice is taken of it by the masters. A few years ago numerous schools in Yorkshire had to be closed for a few weeks, and all the boys sent home to have their eyes examined and treated.

In London the Metropolitan Poor Law Schools send all children with diseased eyelids to the Ophthalmic Schools at Hanwell, which are under the care of an eye-specialist.

The hearing can be roughly tested by a watch, or the boy told to repeat certain words spoken in a whisper at a distance of a few yards. If the boy snores, has a vacant expression, is inattentive and dull, he will probably have nasal obstruction due to adenoids, and these should be removed.

If these simple suggestions were adopted at all private schools (I use the word "private" in distinction from Board schools), a very large number of boys would learn a great deal more, and would be placed in a much better position to fight the battle of life. Many boys have an idea that the chief object in school-life is to go in for sports, and that learning is only a secondary consideration, and that if they only excel in sports they are

doing their duty. In this they are often encouraged by their parents, and even by some masters. When they leave school and have to work for their living they find out their mistake, and wish they had sported less and worked more. The Board Schools are improving day by day, and many parents send their children to them because they can get a better education there than at other schools. Most towns now have a School Board Officer, who though he is not paid very generously, is expected to spend a great deal of his time watching over the children. The masters of private schools should do all in their power to improve their schools, and look after the boys, and one of the first and most important things they can do is to see that any boy who cannot see and hear well should be examined by a medical man, and properly treated. Many parents have a very strong objection to their children wearing glasses. Of course it does not improve the appearance, but children go to school not to look pretty but to work and learn, which they very often cannot possibly do if they do not wear glasses.

(For discussion on this paper, see page 821.)

CARE OF THE EYES OF THE CHILDREN ATTENDING ELEMENTARY SCHOOLS.

By ANDREW LITTLE, M.B., C.M.,

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THE object of this paper is fourfold:—

1. To advocate a careful expert ophthalmic examination of all children at present attending elementary schools, and afterwards, from time to time, as children present themselves for enrolment, first to have their eyes thoroughly examined, and then, as far as possible, to apply what remedies are necessary, or to recommend the form of school work which will not have in any way any prejudicial effect on the eyes;

2. To show that such an examination would isolate a surprisingly large number of children, who, unless properly treated, would be shockingly overtaxed by the school training, or who would pass through school-life without deriving the benefit which has been provided for that child at the expense of the already-overtaxed taxpayers;

3. To show that the present system of examination of the eyes of school children is anything but accurate, and allows many children to pass off as having normal eyes, when, in reality, they have eyes which are in the greatest need of treatment;

4. To advocate the application of a mydriatic in every case by a skilled specialist who is daily engaged in ophthalmic work, and when the careful examination has been made, to recommend what is necessary, instead of sending a message to the parents, who in nine cases out of ten pay no attention to it.

For a child to become educated he or she must be in possession of healthy organs. The special organs necessary for the proper reception of the impulses of education are the sense-organs, the connecting tracts and the central organ, the brain. Disease of any one of those parts will upset

the whole equilibrium. The different parts will functionate according to the nutrition of the child at the time, and for the purposes of this paper I will assume, as far as the general health or the condition of the general economy of the child is concerned, that all is normal, and that the child is in the best of health. There are cases of eye disease which, in the good health of the child, will give little more than passing inconvenience, ending up in adult life as eyes that are none the worse of the ordeal through which they have come. On the other hand, the same eyes under different conditions, impaired health, and the considerable strain of school life, would ultimately end up in what is frequently seen at eye clinics by those who do the ophthalmic work there, and what cannot be conscientiously described as anything else than simple catastrophe.

It will be admitted that in the public schools all makes for ample results as regards education, and that the curriculum of study is all that a child with health, normal sense-organs and brain, etc., can accomplish, so that should a child with any error of refraction be in a class, then that child, in order to keep pace with the others, has to overtax his or her eyes, and sooner or later that child will have the eyes undergoing a change of impairment which it will not be difficult for any ophthalmic surgeon, who examines carefully, to detect.

Seeing that children are pushed on as fast as their normal strength will allow, then it is incumbent on the authority which insists on the child being educated to see that he is physically fit, and that all the sense-organs at least are healthy. As long as the authorities shift the responsibility on to parents so long will the helpless children be left to have their eyes ruined, and as long as the authorities fail to have the eyes thoroughly examined, so long will the educational authorities fail to have the best results from the system they enforce, and so long will the enforcement of that system sow ruin among the eyes of those who are victims, a seed which will mature only after the child has left school and attained manhood. When the child has attained manhood he is then no longer able to compete with the world, but has to take a back seat to the stronger competitors, all the result of this enforced education in the case of those who are neglected in their youth and find it out when too late.

One cannot have a lengthy connection with any of our ophthalmic clinics without being struck by the enormous number of children who come to those institutions for relief, and I have no doubt that that circumstance has had most to do with the fact that so many ophthalmic observers have devoted so much time to this branch of the subject. For more than a hundred years ophthalmic surgeons have been busily engaged

investigating the subject, and up to the present we have in the literature of the subject the reports of the examination of about 250,000 children. From the results of the examination of such a large number, extending over the whole of the last century, ophthalmic surgeons are unanimously of opinion that there is a crying need for a thorough expert examination into each case.

Up till to-day the examination through which pupils have been put has been anything but an accurate one, the object of it being more to try and convince educational authorities of the large percentage of the children who suffer from some defect or other in the eyes, defects which made it very difficult for the children to acquire the education prescribed for them. Those examinations did not show fully the amount of defect which existed in each eye by examination of each eye separately, but only in one. According to Dr. Kerr, the examination of two eyes only complicated matters. I agree with him, but those complications must be overcome in the interests of those sufferers for whose benefit all the work is done.

Owing to the fact that the children have mostly been examined with both eyes open, the results show only the best distant sight of the better eye, and give no record whatever of the other eye. I consider a most important function of the eyes is binocular vision, and when that is absent the worse eye undergoes changes which puts the acquirement of binocular vision later on in life almost out of possible attainment; but had the condition of the eyes been carefully examined in early life a simple correction in the shape of spectacles would have remedied the defect, and made the child much more comfortable at school and better educated when he or she left school, through having been rendered capable of assimilating all the education given.

The examination up to the present has been one that has very much under-estimated the amount of defect existing, still, those rejected by it were all certainly in need of medical treatment, and good has been done by having induced the parents of a certain number to have their children's eyes examined and proper remedies applied, but it is in connection with the children of those parents who do not pay any attention to notices that the responsibility of the authorities is greatest.

There has been a tendency on the part of those ophthalmic observers to rather vie with each other as to who could make the largest show as regards the numbers examined, accuracy as regards the vision of each eye separately, or the same taken under atropine, being of much less importance in their opinion than the necessity of having large numbers to appeal to. It was necessary to have large numbers to appeal to, or rather to have

examined large numbers of children, before the members of the educational authorities would be induced to give the matter their consideration, and in that respect Dr. Kerr has done a great work, accurate as far as the method he adopted would allow, by the figures he showed forcing all educational authorities to wake up. As the outcome of that work, many Boards have had schools examined after his method and doubtless done some good, but I feel that after those examinations have been made and results published the members of the Board sit down quietly, and feel that those defects are too numerous for them to cope with.

The eye is the only organ which forced education causes disease to arise in, so their duty on that account is plain, either to make the eyes capable of bearing the strain of the education provided, or to exempt from education the child who is likely to have his or her eye damaged by it.

If the Boards have powers to pay medical officers for making the examination which Dr. Kerr has advised, then they have powers to pay for the work being done in a workmanlike manner, and they ought to do so.

The work which Dr. Kerr has done on the subject of the eyesight of school children embraces the results of the examination of thousands of children. I quote one of his tables from his work on School Hygiene which gives the percentage results of the examination of about 20,000 children, both for age and standard.

TABLE I. (Kerr).

Showing Visual Acuity Defect in Boys and Girls at different ages.

	Ages:—	6	7	8	9	10	11	12	13
Percentage with visual acuity defective.	Girls:—	51·2	40·4	31·6	29·1	29·0	21·1	21·1	17·6
	Boys:—	44·4	30·9	24·9	20·0	20·0	18·7	17·6	19·8

TABLE II. (Kerr).

Showing Visual Acuity Defect in Boys and Girls in different standards.

	Standard:—	I.	II.	III.	IV.	V.	VI.	VII.	Ex. VII.
Percentage with visual acuity defective.	Girls:—	52·5	35·4	31·6	26·0	23·9	17·1	15·0	8·6
	Boys:—	40·7	28·0	22·3	17·4	18·5	14·4	14·1	9·5

The method Dr. Kerr adopts is as follows:—The teacher does all the work in connection with the examination which is done at the school, and he examines the whole class at a time. He uses his special card. It has letters of a certain size subtending to an angle of 5 inches at certain

distances of 10·12 feet up to 20 feet. These distances become the numerator, and the letters the child sees the denominator of the fraction representing the vision; thus, if a child in the form 10 feet away from the card only saw the letters which a child at 12 feet ought to see, then the vision would be $\frac{10}{12}$. The teacher hangs the card 10 feet in front of the middle of the first bench, in a good light, then he measures the distances of each form from the card and gives the number of feet that the form is from the card to the children occupying the form. He next gives to each child a card with certain blank spaces on it. In those blank spaces each child enters his or her name, age and standard, and the number which the teacher gave to them, being the distance of each seat from the card. There is also a space to fill in, whether or not spectacles were worn. The child next copies down from the test card all the letters seen. Into the spaces for the letters which could not be seen, the child puts a ×, indicating that the letter could not be seen. The teacher, after they have been all filled up, carefully collects them and forwards them to the Medical Officer of the Board. The teacher, after finishing one class, proceeds to examine another class, and so on till the whole school is examined. By this method of examination, Dr. Kerr was able to stagger the educational world by the enormous amount of work which had been done.

The defects of the method are:—

1. There is no provision for the exact vision of each eye being taken.

2. There is no provision to ward against the action of the muscle of accommodation in cloaking the errors of refraction.

3. It does not give the least assistance in analysing the defective cases into their respective classes of error or refraction.

Beyond the useful function of showing how many cases of defective eyesight there are among the children there is no use in it, and I think Dr. Kerr does not claim any more for it.

I carefully examined the children attending the schools of Nelson, and during that investigation carefully tested them by Dr. Kerr's method, next testing them carefully by first recording the sight of each eye separately, and then I instilled a drop of a strong solution of homatropine (grs. viii.— $\frac{3}{3}$) into each eye, and recorded the vision again (see Table III.). I only include in this table the percentage of those who could see $\frac{6}{6}$ with both eyes open in the fourth column, in the fifth column I include the percentage of those who could see $\frac{6}{6}$ with both eyes tried separately, and in the sixth column I record the percentage of those who could read $\frac{6}{6}$ with each eye separately after the mydriatic was used.

TABLE III.

Boys.	Girls.	Standard.	Percentage which read $\frac{6}{6}$ with both eyes together.	Percentage which read $\frac{6}{6}$ with each eye.	Percentage which read $\frac{6}{6}$ with each eye after a mydriatic.
47	—	IV.	85·1 per cent.	80·8 per cent.	57·4 per cent.
—	30	IV.	83·3 „	60·0 „	26·6 „
80	—	III.	82·3 „	70·0 „	46·2 „
—	73	III.	73·9 „	64·5 „	39·7 „
60	—	II.	80·0 „	66·6 „	35·0 „
—	59	II.	64·4 „	59·0 „	32·2 „
43	—	Ib.	53·4 „	27·9 „	25·5 „
—	41	Ib.	34·1 „	24·9 „	4·8 „
61	—	Ia.	68·9 „	63·9 „	30·0 „
—	56	Ia.	69·6 „	44·6 „	10·0 „
291	259	.....	69·5 „	60·4 „	31·3 „

On perusal one will have no difficulty in seeing that the number of defective eyes existing is very much larger than Dr. Kerr's results would indicate, and the next table (Table IV.) brings before you an analysis of those cases of Column IV. of Table IV. which after homatropine could not see $\frac{6}{6}$. I carefully collected those cases of the left eye that were able to read $\frac{6}{6}$ before the mydriatic, and tabulated them according to their vision after the midriatic had acted. Table IV. gives those visions. Column I. gives the standard, column II. gives the number of boys examined, and III. the number of girls. Column IV. gives the percentage of left eyes that read $\frac{6}{6}$. The following percentages are the percentages of those eyes that read $\frac{6}{6}$ before the drops, arranged according to the vision after the drops had acted.

TABLE IV.

Standard.	Right eyes. Boys	Right eyes. Girls	Number reading $\frac{6}{6}$ before the drops.	The percentage visions of those eyes that read $\frac{6}{6}$ before instillation of drops arranged according to the vision after the drops.							
				$\frac{6}{6}$	$\frac{6}{9}$	$\frac{6}{12}$	$\frac{6}{18}$	$\frac{6}{24}$	$\frac{6}{36}$	$\frac{6}{60}$	$\frac{6}{0}$
				Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
IV.	47	—	39	76·6	15·3	7·6	—	—	—	—	—
IV.	—	30	21	38·0	9·5	23·8	4·7	9·5	9·5	4·7	—
III.	80	—	59	54·2	16·9	10·1	3·3	3·3	3·3	—	—
III.	—	73	52	55·7	17·3	15·3	—	1·9	5·7	3·8	—
II.	60	—	43	58·0	25·5	6·9	6·9	—	2·3	—	—
II.	—	59	35	54·2	22·8	5·7	2·8	11·4	2·8	—	—
Ia.	61	—	38	60·5	26·3	5·2	2·6	2·6	2·6	—	—
Ia.	—	56	33	36·3	21·2	18·1	9·05	6·05	3	6·05	—
Ib.	43	—	16	37·5	56·2	—	—	6·25	—	—	—
Ib.	—	41	11	27·2	45·4	—	9·05	—	18·1	—	—

TABLE V.

Standard.	Left eyes. Boys	Left eyes. Girls	Number reading $\frac{6}{6}$ before the drops.	The percentage visions of those eyes that read $\frac{6}{6}$ before instillation of drops arranged according to the vision after the drops. $\frac{6}{6}$	$\frac{6}{9}$	$\frac{6}{12}$	$\frac{6}{18}$	$\frac{6}{24}$	$\frac{6}{36}$	$\frac{6}{60}$	$\frac{6}{0}$
				Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
IV.	47	—	39	74·3	10·2	7·6	2·5	—	—	2·5	2·5
IV.	—	30	21	38·0	9·5	19·0	4·7	4·7	14·2	9·5	—
III.	80	—	62	66·1	12·9	3·2	8·0	3·2	4·8	—	—
III.	—	73	51	62·7	15·7	9·8	5·9	1·9	1·9	1·9	—
II.	60	—	43	55·8	25·5	11·5	4·6	—	—	2·3	—
II.	—	59	37	56·8	16·2	8·1	8·1	2·7	—	2·7	—
Ia.	61	—	37	62·1	21·6	5·4	—	10·8	—	—	—
Ia.	—	56	32	18·9	28·0	6·3	25·0	6·2	—	15·4	—
Ib.	43	—	18	50·0	38·8	5·5	5·5	—	—	—	—
Ib.	—	41	13	46·1	23·0	—	—	7·6	15·2	—	—

Take the second line of visions in Table IV.—it will be seen that of the thirty girls of standard IV. examined by carefully recording the visions of the left eyes, only twenty-one were able to read $\frac{6}{6}$, and when hom atropine was put into each eye, they then were able to read as follows: 38 per cent. of the twenty-one read $\frac{6}{6}$, constituting as far as the focus of rays of light on retina normal eyes. 9·5 per cent. of them read $\frac{6}{9}$, 19 per cent. of them read $\frac{6}{12}$, and 4·7 per cent. of them read $\frac{6}{18}$, 4·7 per cent. of them read $\frac{6}{24}$, 14·2 per cent. of them read $\frac{6}{36}$, and 9·5 per cent. of them read $\frac{6}{60}$. Those were eyes which up to the present have been considered normal.

The children of the Bradford schools are still being examined according to Dr. Kerr's methods, and notices are still being sent to the parents of those children whose cards indicate bad vision. Out of those children only about 500 per annum come to the Eye and Ear Hospital for treatment (that is a little over 3 per cent.), when about ten times that number has been notified. A great number go to those eye quacks who advertise eyesight-testing rooms, etc., I wonder the people tolerate such such establishments.

In conclusion, I think it is plainly evident that the defects are numerous enough to give serious concern to those men and women who constitute the educational authorities, and have the making or the marring of the eyesight of those pupils under their charge.

The sentimental prejudice of parents would in a trivial number of

cases stand in the way of the Boards doing the work thoroughly. A few people would probably object to drops being put into the eyes of their children, but before any serious objection could be taken, the effect would have passed off. The objection that to put a drop into the eye is an assault, is to speak childishly.

When I examined the eyes of the children at Nelson, the parents were asked whether or not they objected to drops being put into the eyes. About half of them objected, but during the examination I forgot who objected and who did not, so I put drops into the eyes of all and never heard a single complaint. It is very rare to hear a parent object to allow the pupils to be dilated in the case of those taken to the Eye Hospital. If the parents are told it is necessary for the good of their child's eyes to have drops instilled, and examined of course by doctors who are well qualified, then a very small proportion will be found stupid enough to object. There are plenty of qualified ophthalmic surgeons who are willing to do this work conscientiously, and to do the work as it ought to be done. The children, taken as a whole, would be greatly benefited by having their defective eyes remedied as far as it is possible to do so, and why is it not done? Simply because the educational authorities fail to vote the necessary amount of money to pay properly qualified ophthalmic surgeons to do the work, and through not doing so, force the children to submit to education which instead of preparing them better for the position of trustees of the destinies of this great empire, leaves them ophthalmic cripples, a burden to the empire instead of a help. Penny wise and pound foolish!

(*This discussion applies to the papers by* Dr. A. BRONNER *and* Dr. ANDREW LITTLE.)

MR. A. UPSON (Maidenhead) said that they might have expected some advice as to the prevention of the defective eyes, and also of the adenoid growths so common. They had been told that they should have a care that children were taught correct breathing, and he certainly thought that he would have heard something on the subject. It was a great mistake to imagine that teachers were competent to undertake the examination of the eyes. They were told that the ordinary medical man was not trained or able to do this unless he had received special training, yet he found that there were some specially trained for the work against whom the papers had something very strong to say. With regard to myopia there certainly was an improvement. The old-fashioned desk had

been done away with, and he read now that there were desks entirely suitable for school use. If, in the reply, the section was told how teachers were to know how to tell when children had myopia or adenoid growths it would be useful.

Mr. Lishman (Bradford) said that in the Bradford Schools the desks were constructed according to the directions of Dr. Kerr. Dr. Kerr took the height of 300 or 400 boys according to ages, and the desks were made to suit the average. The distance of the seat was regulated so as to prevent lolling on the desk. A boy was now obliged to sit upright and the desks were also provided with backs.

Dr. Crowley (Bradford) said that Dr. Little certainly showed an ideal method of examining the eyes of the children, which might perhaps get carried out in the distant future. In the system adopted in Bradford, the preliminaries were carried out by the teacher, who placed a test-card before the children, and the letters on it were written down by them at certain distances. Standard I. was excluded. These papers were then separated into correct and incorrect. He then tabulated the incorrect ones, and the children who showed any marked defect were seen by him. The head teachers were also invited to bring out any other children whom they thought might be defective in eyesight. By personal investigation in this manner but few children with defective sight could escape. Records were kept and compared from year to year. The great point to aim at was to prevent eye-strain in the curriculum. He could not accept the conclusions which Dr. Little drew from his examination of children under homatropine, and he did not believe that correction by glasses was required in anything like so many children as seemed advisable to Dr. Little.

Dr. Childs (London) said it was difficult for the laity to realise how common defective vision was amongst children. It was a frequent experience with ophthalmic surgeons to find in children supposed to have excellent vision that one eye was very defective. Testing of vision was often deceptive unless the vision of each eye was examined separately. He supposed, however, that Dr. Kerr's investigations were preliminary to a more complete investigation. The suggestion that the eyes of children should be tested under homatropine, if intended as a counsel of perfection, was delusive. Ophthalmic surgeons were fully aware that it was necessary to fully atropise the eyes in order to gauge the refractive conditions of the eye exactly; a process which, with a large number of children to be examined, was quite impracticable.

Mrs. Kirk (Bradford) said that the question of eyesight had caused her to revolutionise the teaching in her school. Infants should be especially considered,

as in the earlier years of a child's life the training it received was all-important. She should be very glad to get more information upon the subject, as she considered it of very great importance to teachers and parents.

Mr. Garbutt (Bradford) said that in the Bradford infant schools, instead of having fixed desks they had little tables, and four small chairs instead of long, continuous seats, which were so awkward to work with. A conclusion had been drawn from which he begged to differ very respectfully; that was where attention was drawn to what was termed the present "cast iron curriculum." Such days were gone. In making such a comment it would be unfair that such opinions should be given to the world as being endorsed by the members present. Attention was called to the results of a systematic examination of children on page 810. In some of the voluntary schools the results must be even worse than in the Board Schools. Then on page 815 Dr. Little said that a child must not be pushed on too fast. He believed that managers as a body, and school teachers as a whole, did deem it to be incumbent upon them to see that, as far as possible, each child was physically fit for the work he was required to do. He did not quite follow, himself, the necessity for the expert ophthalmic examination upon admission. Dr. Little said, "as long as the authorities shift the responsibility on to the parents so long will the helpless children be left to have their eyes ruined." He could not accept that statement. The authorities did not shift the responsibility on to the parents. He believed that the Government thought that the authorities were shifting the responsibility from the parents far too much.

Mr. William Scatterty (Keighley) said that from what had been said laymen would naturally think that at least half the population were suffering from defective eyesight. These defects were relative, and ought not to be compared with the standard of the adult. Those who had been examining the same children year after year noticed a considerable improvement as the child developed, and he would not like the people to think that half the children had bad eyes.

Dr. Bronner (Bradford) in replying, said that a child should keep its head well up when reading, writing, etc. If necessary it should have proper glasses. As regards the prevention of adenoids, from a medical point of view there was no doubt that children should be *taught* how to breathe. Of course adenoids depended greatly upon the surroundings of the child, such as a damp house or climate. Short sight was the outcome of civilisation and as he had mentioned before, it depended a great deal upon the shape of the orbit. He suggested that the teachers should test the children's vision periodically and report to the medical officer, who would examine the eyes of those who were deficient.

Dr. Little (Bradford) thanked those teachers and others who had discussed the previous papers in a popular way, for the interest they had taken in a subject which was of such vital importance to those children taught by them, but from the popular nature of their remarks little value medically could be attached to them. High myopia, with all the troubles following in its trail, was frequently the direct outcome of over-application of the eyes to near work, and he had yet to learn that any other sense organ, from the application of it to the acquiring of education, was in any way pathologically affected. As regards the tables of figures given, they were only two examples from a great many more in his possession, and were only given to illustrate the contention that a great many of the children, who were examined by methods which did not include the use of a midriatic, were returned as normal when their eyes were in crying need of treatment. As regards the accuracy of the figures he could only invite Dr. Crowley to do similar work under similar conditions, and then let his views be heard. In reply to Mr. Garbutt, he would like to say that his experience was that parents in the majority of cases were not educated to the importance of attending to the notes sent from the school-board respecting their children's eyes, so in the interests of those children the boards ought to see to them. When the board's medical officer had notified the parents that their child had defective eyesight the board was responsible if the education of that child were allowed to go on.

WARMING AND VENTILATING OF PUBLIC SCHOOLS.

By D. M. NESBIT, M.I.Mech.E.

THE proper Warming and Ventilating of Public Schools has been for a long time sadly neglected, and it is a matter for congratulation that the public generally are awakening to this fact, and that in the near future this state of things will be remedied. That child-life should be surrounded with all that pertains to a healthy and life-sustaining atmosphere none will deny, and it is to this end that the author has given much time and attention to that branch of hygienic science dealing with "Good Warming and Ventilating."

To deal broadly with the subject, we may divide the schools into three groups, sub-dividing these for further elucidation as may be necessary.

(*a*) Small Schools.
(*b*) Medium-sized Schools.
(*c*) Large Schools.

In dealing with small schools, say up to 400 accommodation, it is found difficult, on the score of initial cost as well as permanent up-keep, to instal a system of warming and ventilating that would satisfy the most exacting, but a simple form of warming and ventilating may be carried out that would give much better results than those usually obtained at the present time.

Low pressure hot water or low pressure steam may be used as the heating medium with radiators fixed on the external walls, preferably under a window remote from the seating accommodation, the radiators being supplied with fresh air passing through a louvred grating fixed on the internal walls, with a handle arrangement fixed thereto for the teacher to operate, thus admitting more or less fresh air as desired.

The ventilation (or extraction) may be by flues built in the walls in the most suitable positions, rising upwards and discharging into the outer atmosphere, or descending into a common horizontal duct which commu-

nicates with a vertical shaft, as shown in drawings Nos. 1 and 2. The latter plan is preferable, however, because it has been found by practical experience that "Siphonage" goes on when numbers of flues go upwards and discharge into the outer air. Practical knowledge and experience have proved that such flues often act in a contrary direction, allowing the air to come into the rooms instead of performing their proper function as outlets.

In medium-sized schools the same plan as in small schools may be adopted if first cost alone is to be considered; but in large cities and towns it is more preferable to adopt a system of warming and ventilating by which more positive results may be obtained. To obviate much of the first cost, a system has been designed which can be worked either automatically or mechanically, as may best suit. It will be seen from the diagram facing p. 828 that the heating surface is placed within a cabinet designed to harmonize with the architectural treatment of the building. This cabinet need not be of any *stock* design, but may be treated by the architect or designer as part of the ornamentation of the hall or compartment in which it is fixed. It may be constructed in glazed brickwork, faience, terra cotta, cast or wrought iron, gunmetal or brass, or in hard woods polished, or even in the softer woods, painted to suit the general scheme of decoration.

This system has been carefully designed so as to insure cleanliness, orderliness, and easy manipulation.

When the doors are closed, as shewn in sketch, the cabinet looks just what it is intended to be, viz., a cupboard or receptacle for safe keeping of the heating apparatus out of the reach of the children. It does not occupy useful space, as it can always be placed in a side wall on the teaching sides of class rooms. For regulating the supply of air and heat, the teacher has only to open the door, regulate the shutters for the supply of air, or the valve to the heating apparatus for the supply of warmth, then close the same again until another operation is necessary. When the doors are open, the inclosed space and that which it contains is immediately under the view of the head teacher or manager, whose inspection should be a sufficient safeguard against the use of the cabinet for placing within it any articles or material foreign to the purpose it is intended to serve.

Another manifest advantage of the cabinet is that it gives absolute security against harm coming to the children, as no hot radiators or pipes are within their reach. The air inlet to this system is arranged at a height of not less than 6 feet from the outside ground-level, and it need

not be more than 8 feet. This prevents the entrance of much dust and other deleterious matter, which is carried upon the lowest stratum of the outer air; but, to insure the fullest security in this respect, the system has been designed to include filters for the efficient removal of all dust particles that may be contained in the incoming air. It will be readily understood by those who have closely studied the question that the incoming air taken at a level of 6 feet above the ground is of better quality than that which usually passes in through radiators fixed in the ground floors of buildings.

The process of extracting the vitiated air may be similar to that considered for small schools, with the addition that if a vertical air shaft is adopted a cast-iron smoke pipe may be fixed in the centre of same, which as it becomes heated rarefies the air, causing it to ascend and making the ventilation positive, without any extra cost to maintenance account.

In large schools where the numbers of children vary from 800 and upwards, and the class-rooms becomes congested at times by the large numbers of children assembled for special purposes, the author has come to the conclusion that nothing short of mechanical warming and ventilating will suffice to keep the air in a healthful condition. Taking the *best air* as we find it, having *three* to *four* volumes of CO_2 in 10,000 volumes, it has been the aim of the author to get as near this standard as possible; and whilst it is not practicable to obtain it in many of our industrial cities and towns, it has been possible to keep down the CO_2 to 6 and 7 volumes per 10,000. This is good practice, but our aim should be to do more where the initial cost and maintenance is not considered a a vital matter. In passing, the author wishes to compliment the Bradford School Board upon its militant policy in respect to good warming and ventilating. The time is not far distant, if it has not already been reached, when the results of this vigorous policy will be manifest in those who have the good fortune to be housed and educated in some of the schools of the city referred to.

The standard volume of air should be, according to the author's experience, not less than 1,700 cubic feet of air per child per hour, and the maximum need not be greater than 2,000 cubic feet. The speed of the incoming air should not exceed a velocity of 5 feet per second on an average, over an inlet-grating. This may seem to be a considerable requirement, but it is easily to be obtained, by insisting upon having large air ducts, vertical flues and inlets into the rooms of ample area, and large fans to run evenly and slowly. These desiderata must be at the foundation of any good system of warming and ventilating, and without them failures will be many and obvious.

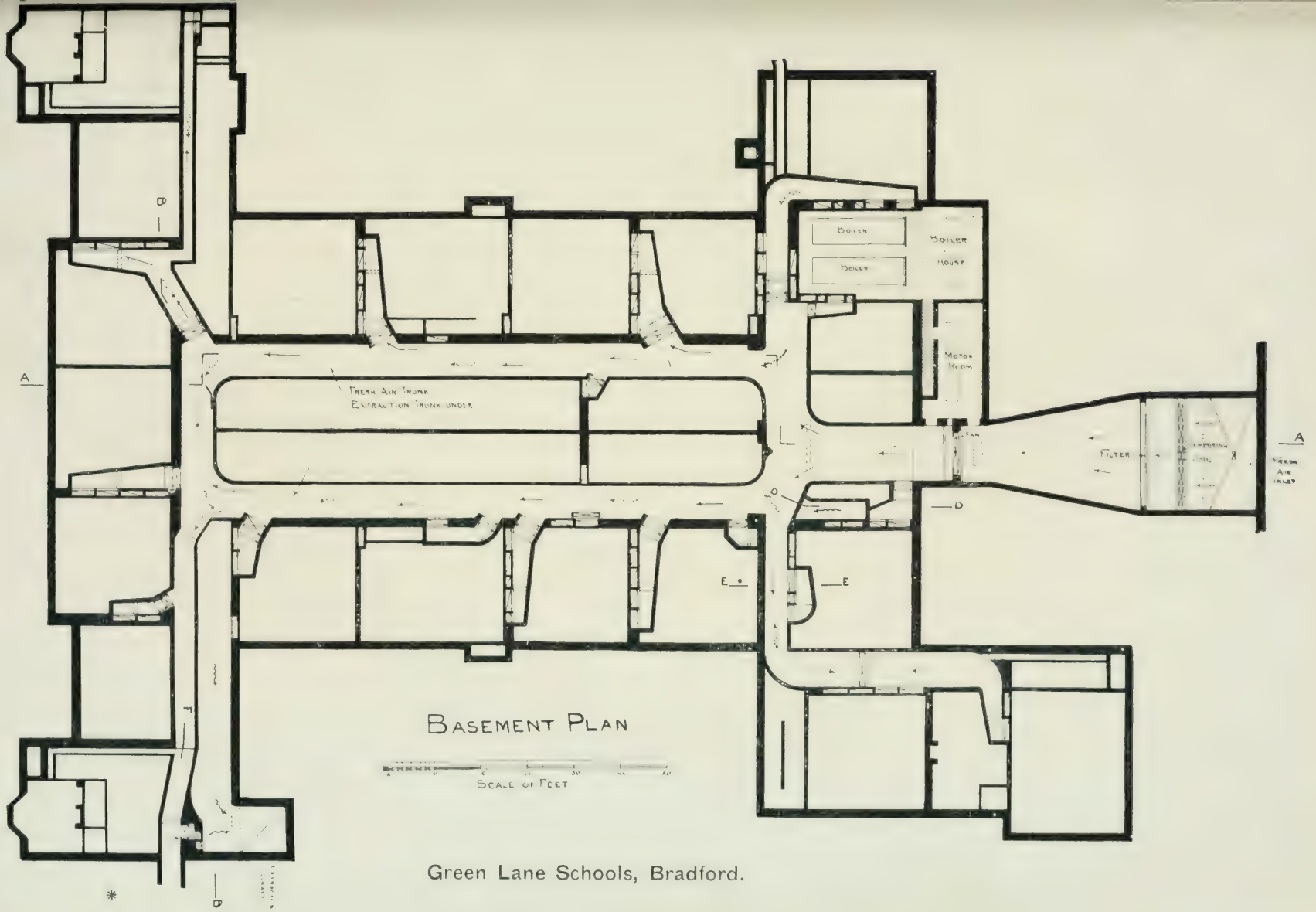
The air inlet should be of ample size, and its location should be determined with a view to obtaining the air supply from the best and purest source near the school buildings. It should lead up to a filter, the design of which may be left to the engineer, as there are several good forms in the market at the present moment. The author has used Jute and Coke, with a water spray attached, to clean the air as it is passing into the school buildings; but the spray should be used with judgment, as it is likely, if used freely, to make the air too humid, and many medical men and scientists object to the incoming air being overcharged with moisture. It is not always realised that in this country the air has sufficient humidity in itself and seldom requires moisture added to it unless it is being heated.

During winter months, when the air must be warmed, it should be moistened, after passing through the steam batteries, by means of a jet of steam or water fixed just behind the heating surface.

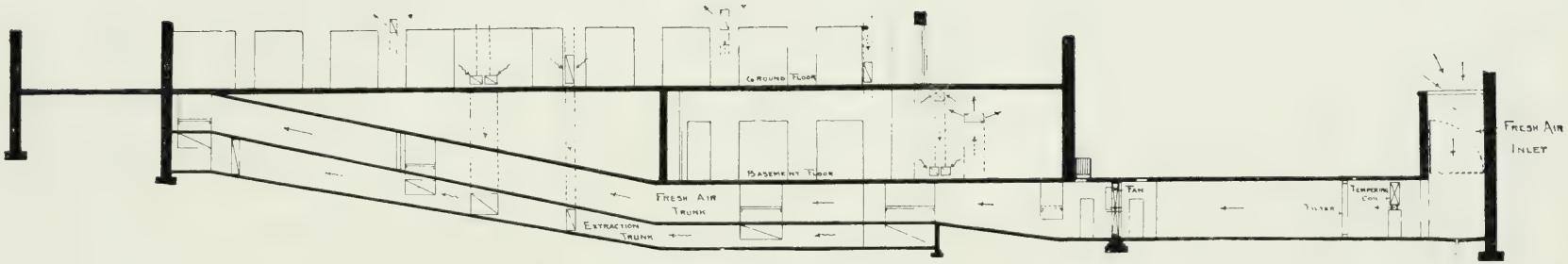
In installations where the heating agent is high-pressure steam, or high-pressure hot water, however, it is necessary to add moisture, as the air in its normal state, passing over highly heated surfaces, such as steam at 20, 30, and 40 lbs. working pressure (temp. 259°, 274°, 287° Fahr. respectively) loses much of its vitality, and may be said to be burnt. The author does not use steam at such pressures, but adopts the maximum pressure on the boiler of 5 lbs., which is equal to 228° Fahr., and frequently steam at 0 lbs. to $\frac{1}{2}$ and 1 lb. not exceeded is used, and a perfect circulation is obtained.

To effect this ideal system, much care and thought must be given to the design of the apparatus, and large boilers, pipes of large internal diameter, and heating surfaces of ample power must be used to obtain the best results. These requirements may somewhat militate against the scheme at first sight, but when all things are considered and when the maintenance is taken into account, the disadvantages of first cost are far outweighed by the easy working and permanent up-keep of such an installation. The leading ducts should not be less than 6 ft. to 6 ft. 6 in. high to allow the management, the teachers and caretaker to walk in them freely. This also enables the ducts to be kept scrupulously clean, and regular inspection would prevent the use of the ducts for the storage of lumber, and be a security against the thoughtless deposit therein of rubbish, the presence of which must vitiate the air, possibilities which, as the experience of the author has shown, are by no means remote, but easily averted.

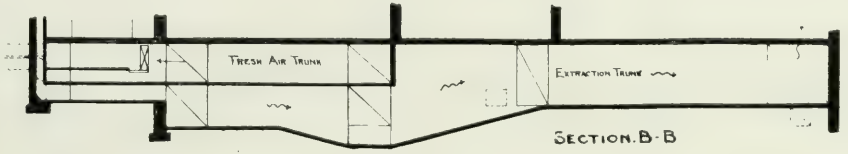
The vertical fresh air flues should be so arranged as to be easily "get-



Green Lane Schools, Bradford.



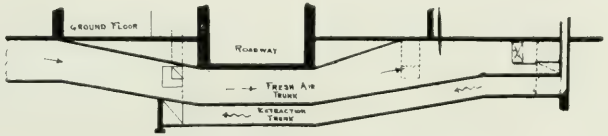
SECTION A-A



SECTION. B-B

SECTION D-D

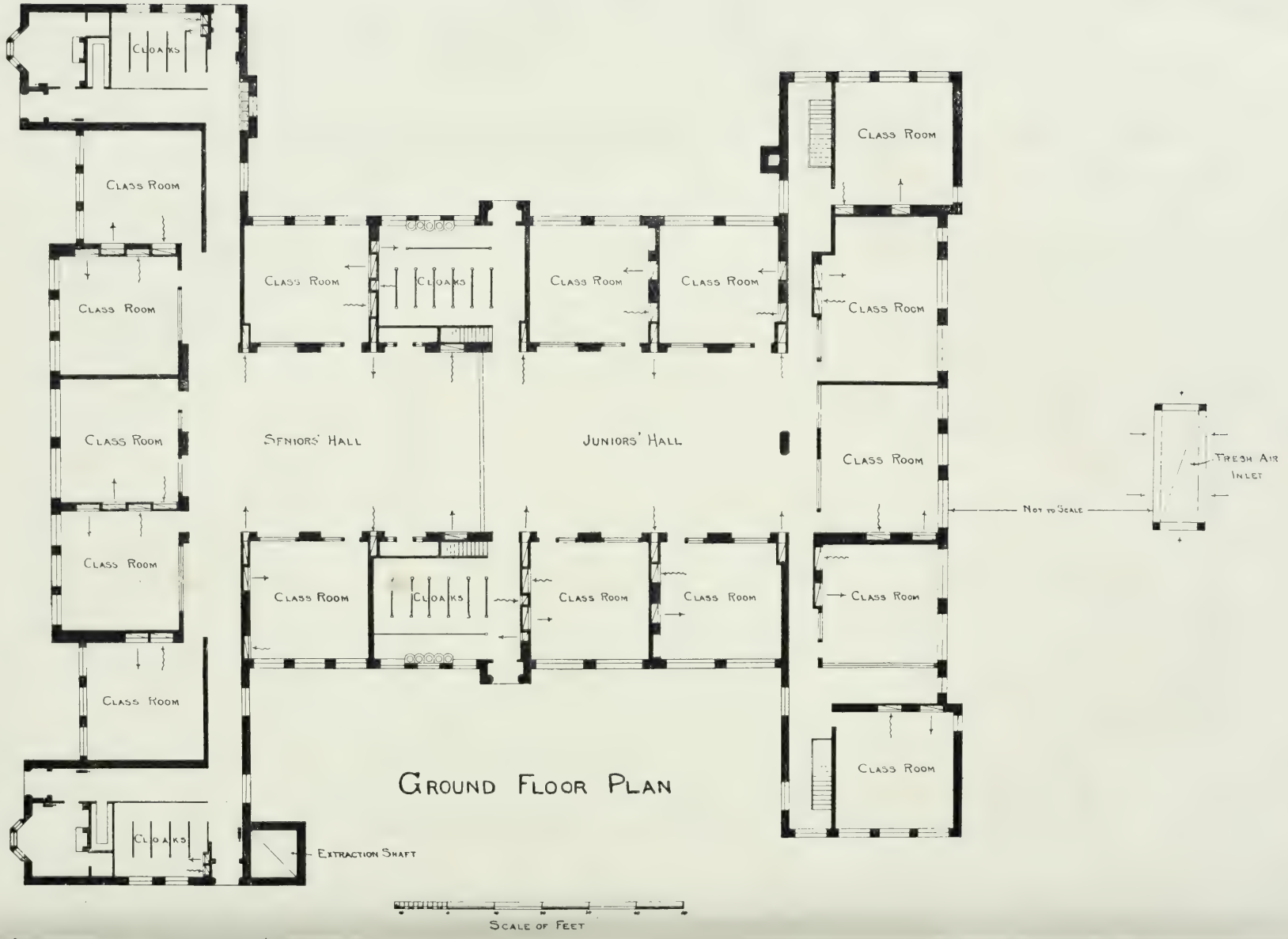
SECTION E-E



SECTION F-F

Green Lane Schools, Bradford.

Green Lane Schools, Bradford.


Cloaks
Class Room
Class Room
Class Room
Class Room
Class Room
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Class Room
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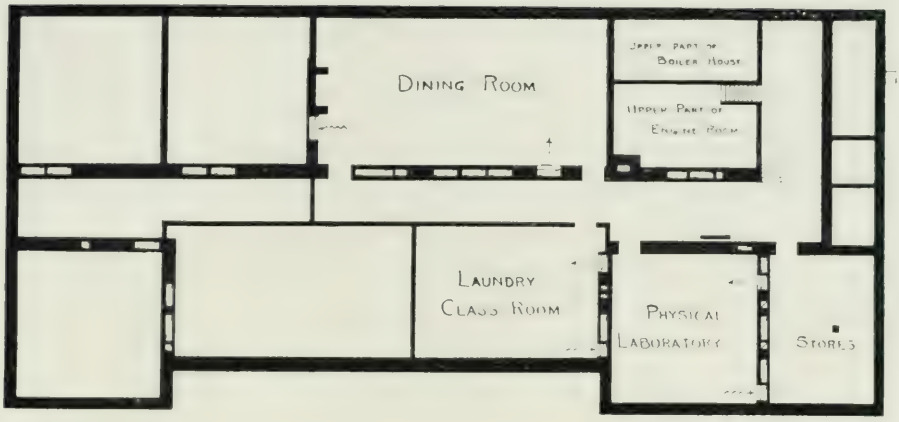
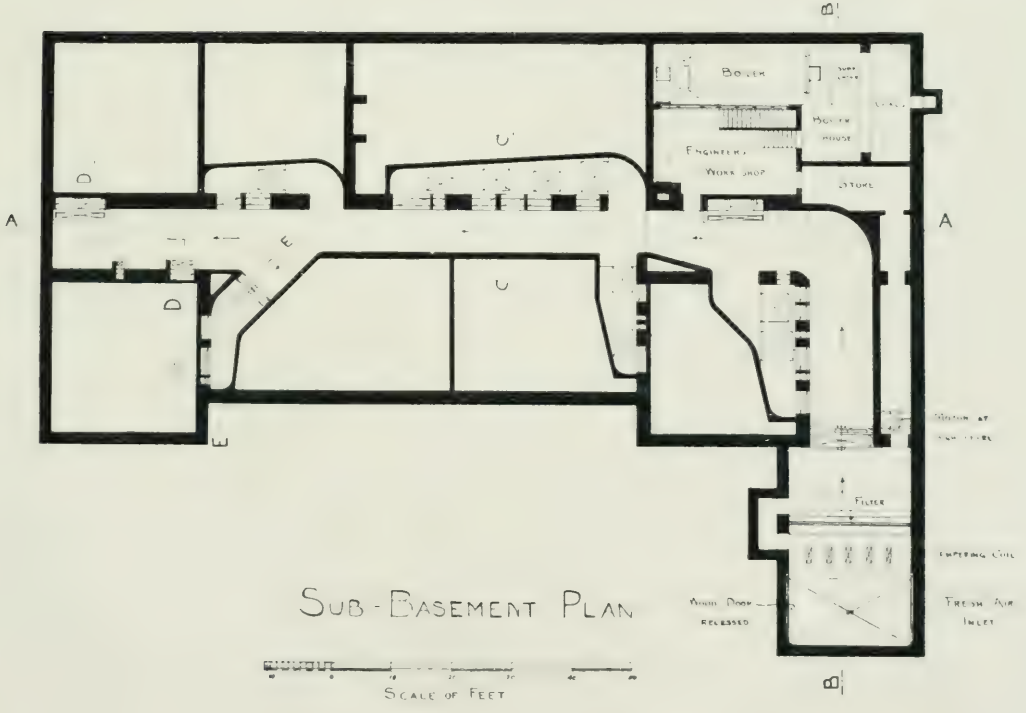
Class Room
Class Room
Class Room
Class Room
Class Room
Class Room
Seniors' Hall
Juniors' Hall
Cloaks
Cloaks
Cloaks
Cloaks
Extraction Shaft
Not to Scale
Fresh Air Inlet
Ground Floor Plan
Scale of Feet

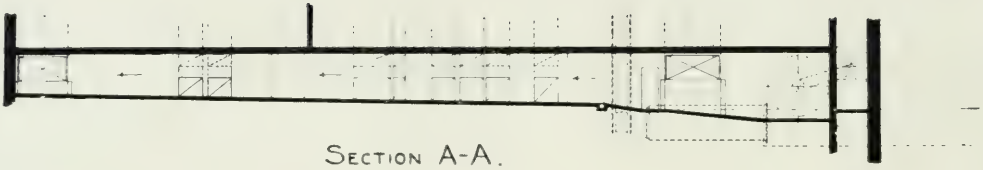


Basement Plan

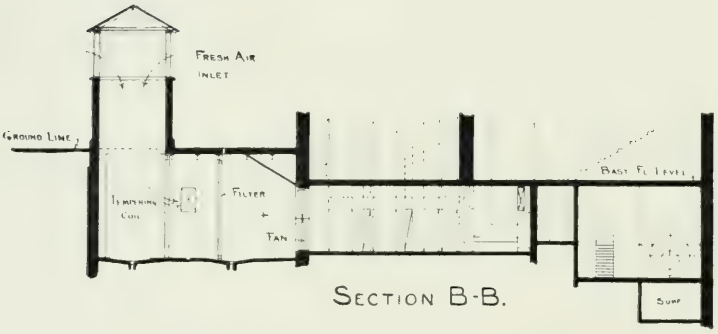


Sub-Basement Plan

Carlton Street Schools, Bradford.



SECTION A-A.



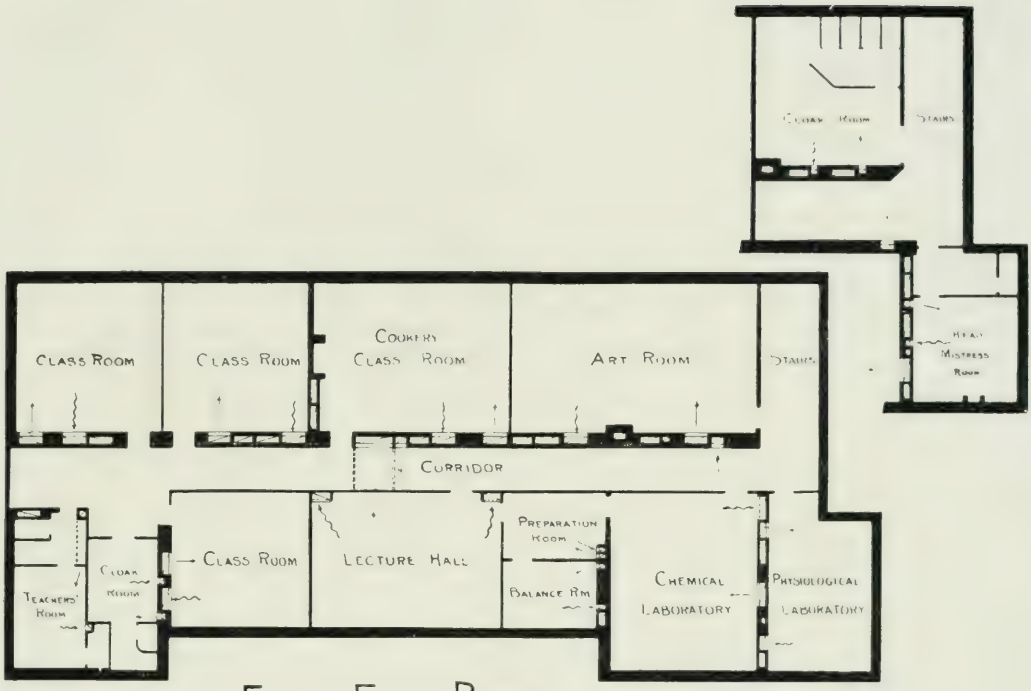
SECTION B-B.

SECTION C.C

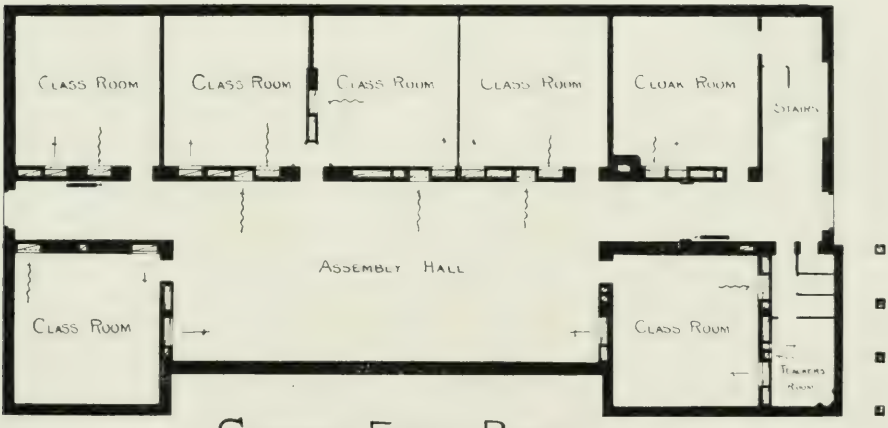
SECTION D.D

SECTION E-E.

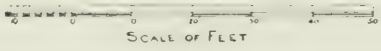
Carlton Street Schools, Bradford.



First Floor Plan



Ground Floor Plan

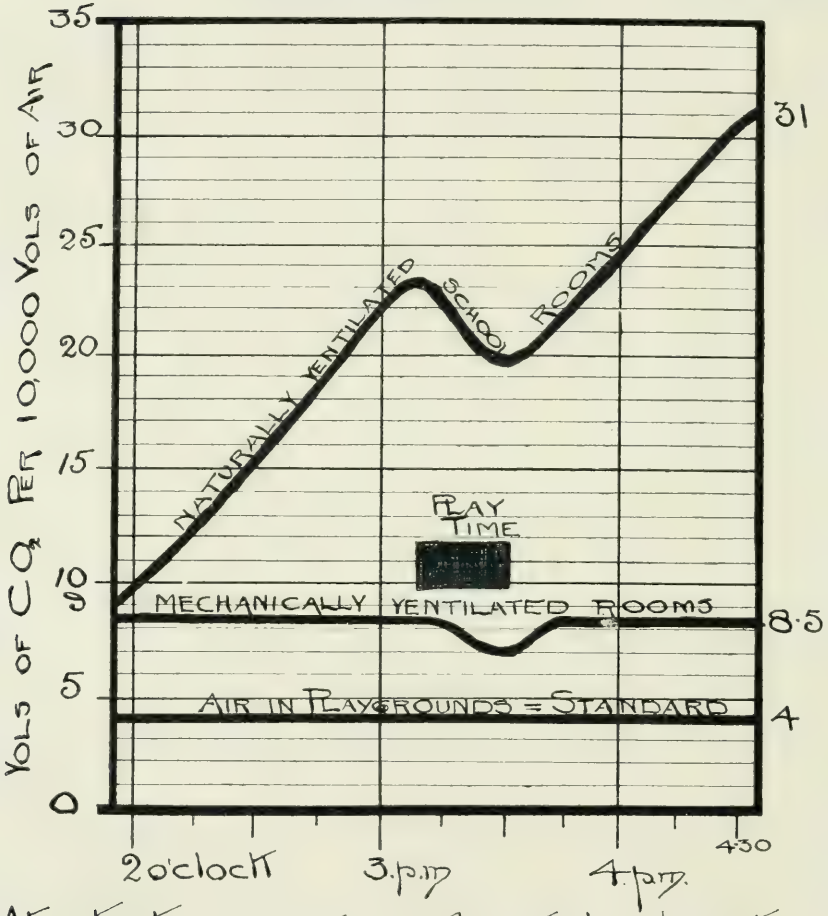


Carlton Street Schools, Bradford.

—BRADFORD BOARD SCHOOLS—

— DIAGRAM —

compiled from 250 estimations from Air taken from a height of 2'-6" from the floor in various classrooms by J. KERR M.D SEPT 1897



At a test made recently at the latest School viz:- Green Lane, Bradford, during school hours the $C.O_2$ was found never to exceed 6 vols in 10,000 vols of Air.

at-able" from the bottom, finally discharging into the class rooms about 8 to 9 feet above the floor line.

The ducts and vertical flues should have smooth surfaces, so as to give as little resistance to the inflowing air as possible and prevent the lodgment of dust particles or other deleterious matter upon excrescences or irregularities. The ducts ought to be limewashed at least once a year, preferably during the school's summer vacation.

The fans should be of the open-blade type, as they are easily kept in order, and cost much less to run. It is, indeed, a matter of astonishment, as in instances afforded in this city, how such large volumes of air can be moved at such small cost.

Carlton Street School, Bradford (see Illustrations 5, 6, 7), is a typical example of the low cost of running the open-bladed fan such as we use.

The cost of running a fan 10 feet in diameter at 90 revolutions per minute, delivering 2,115,000 cubic feet of air per hour, is only 1·3 pence per hour. This is equal to providing the children with 1,540 cubic feet of air each per hour.

The boiler recommended by the author for this class of work is the Cornish or Lancashire type of steam-boiler, without cross-tubes, but having a good grate-surface, so as to readily form steam of *low* pressure, as it must not be *forgotten that it is not pressure of steam* that is required quickly, but *volume*. The coal consumption of the schools cited will compare favourably with any school in the kingdom for its economy.

The ventilation or extraction of the vitiated air of a school containing, say, 1,500 children, each having 2,000 cubic feet of air per hour provided for them, equals in the aggregate 3,000,000 cubic feet of air per hour, and weighs 250,000 lbs., or nearly $114\frac{1}{6}$ tons' weight of air, to be dealt with every hour the school is in session, and this obviously presents in itself no mean problem.

Several plans have been tried, but the one the author finds to be the most successful is shown on plans 3 and 4.

Here the extraction of the class rooms passes through gratings which form the risers of the galleries, by which means equal diffusion or distribution of the air is obtained. After having passed through the risers the air enters the triangular-shaped duct, which in its turn communicates to the horizontal vitiated air duct, thence into the vertical upcast shaft; and finally into the outer atmosphere at points well above the ridge-line of the buildings.

This means of extracting the air from buildings is often termed a

Vacuous System, and has given very good results. It is all that is needed where the vertical extract shaft can be made of sufficient sectional area to deal with such huge volumes of vitiated air; but where the area of the shaft is small or restricted some help must be given them in order to obtain the desired result.

This may be done in several ways :—

1. By means of a cast iron flue-pipe conveying the gases from the boiler, as already described.
2. By having some heat, either by steam or hot water, at the base of the shaft.
3. By having a fan fixed near the bottom or even at the top of the vertical shaft, to draw the air along the ducts and discharge it into the upcast shaft.

The last plan, although more costly to operate, is, to the author's mind, the best, as it ensures positive extraction, and because an exact output can be determined upon and obtained any day and at all seasons of the year. It also has this advantage, that if anything goes wrong with the Plenum fan the ventilation would still be going on in a modified form, until such time as the fan for propelling the fresh air into the building could be put in proper action again.

The fans may be driven by steam, by a gas engine, or by electric motors ; but wherever electricity is possible it is to be recommended, as there is no noise from the motor, the speed can be regulated to suit the working conditions required, and there are no disagreeable smells to be got rid of as in the case of gas or steam engines. The cost of working an electric motor is remarkably low, as will be shown by examples given in the schedule at the end of this paper.

Our present successes, however, and those which we hope will in the future surpass them, have not been, and cannot be attained by regarding such a subject as this from purely monetary considerations. They have resulted in the past from thought and study actuated by enthusiasm for those direct benefits to the community generally which are the best rewards for all the care and labour that can be bestowed. The consciousness of immense opportunities of conferring these benefits by still further discovery and application of the principles of health, so far as they relate to the provision of good atmospheric conditions, afford at once my apology for the length of this paper and the foundation of my desire to extend whatever advantages are afforded by my particular knowledge and experience in these directions.

Tests of ventilation at these two schools upon June 10th, and June 24th, 1903, respectively, gave the following results:—

Carlton Street Schools.—Total air supply per hour, 2,617,500 cubic feet: air changed average 13·1 times per hour in class rooms; total air supply per head of accommodation per hour, 2,460 cubic feet in class rooms, maximum (class room 21) 2,800, minimum (class room 9) 2,000; electricity used, 2 units per hour. During the test an analysis of the air was taken, and the CO_2 contained therein averaged 5·781 vols. per 10,000 vols.

Green Lane Schools.—Total air supply per hour, 3,255,620 cubic feet: air changed average 10·8 times per hour in class rooms; total air supply per head of accommodation per hour, 1,875 cubic feet to class rooms, maximum (class room 6) 2,250, minimum (class room 11) 1,650; electricity used, 5 units per hour. During the test an analysis of the air was taken, and the CO_2 contained therein averaged 5·892 vols. per 10,000 vols.

Schedule.

School.	Size of Fan.	Revs.	Cost per hour in pence.	Cubic feet of air per hour.	Weight.
*Carlton Street ...	10′ 0″	90	1·3d.	2,115,000	176,250 lbs.=78 tons.
Green Lane ...	9′ 0″	176	5d.	3,069,000	255,750 lbs.=114 tons.

* The total cost for electricity for running this Fan equals £10 per school year.

Fuel Consumption (Carlton Street).

Coal ...	£80	11	4
Coke ...	0	14	0
Firewood ...	2	12	0
	£83	17	4—1,376 children = 1s. 2½d. per child per annum.

Cost of Fuel for Bradford Schools, showing *ratio* between Mechanically and Automatically Ventilated Schools. The basis of computation is taken on 10 ft. super of floor space.

	1899.	1900.	1901.	1902.	1903.
Mechanically	7·000	9·44d.	14·9d.	11·1d.	10·12d.
Automatically	7·870	10·25d.	14·8d.	12·4d.	11·46d.

Automatically means the so called "Natural Ventilation."

The author is indebted to Dr. Kerr for the chart shewn on page facing 829, which gives a CO_2 test in 250 estimations, and it will be obvious to those present that the mechanically ventilated rooms are by far the healthiest in the whole schools under the Bradford Board.

These installations were erected by Messrs. Ashwell & Nesbit, Limited, Engineers, London, Leicester, Manchester.

The Cabinet system is patented and known as Nuplenumette.

Mr. W. Claridge (Bradford) said that in 1874 the Bradford School Board inquired thoroughly into the ventilation of schools, and, as the result, found that mechanically ventilated ones were much better than those naturally ventilated. Carlton Street Board School had certain defects which they were trying to overcome, but the Green Lane School was very well ventilated.

Mr. Garbutt (Bradford) said that in the newer schools the double duct system was being used.

Dr. Hartley (Leeds) said that the system of ventilation was one that he had advocated several years previously, and he was glad to be able to report that the newer schools in Leeds were all ventilated on that system, and with results that were remarkable. It was an obvious and very hopeful way of solving the difficulty. He would be very glad to hear Mr. Nesbit say anything further on the subject.

Dr. Kerr (London) said that there was no comparison between the plenum system and natural ventilation. Natural ventilation, in fact, meant no ventilation in most schools. The plenum system meant that doors and windows must be shut, but that alone gave a feeling of "closed-in-ness" to the people who worked in the room. Then, again, there was a want of moisture in the air, and the air was dead; which, he thought, came about chiefly where the passage of air was just sufficient to change it. That was a point which, he thought, had not been sufficiently worked out, and it could be obviated to a great extent, because they could have propulsion on the one side and extraction on the other. For that reason he thought the double duct system ought to be a great success.

Mr. Nesbit (London) said he thought that it would be an easy matter to reply to the various speakers, as most of the criticisms had been of an approving character rather than otherwise, and in the main favouring mechanically ventilated schools. There was no doubt that where mechanical ventilation had been used in schools and asylums the health of the children and patients had benefited considerably. They had strong evidence in Leicester, where the children attending mechanically ventilated schools were more healthy than in the case of non-mechanical or so-called automatic or naturally ventilated, and he thought those

present would agree with him that Dr. Kerr's diagram attached to his paper brings this out very forcibly. The male annex to the Nottingham City Asylum was the first modern mechanically ventilated installation carried out in this country. This has worked exceedingly well, and the cost of upkeep has been very small. In this installation downward extraction was effected and has always given the greatest satisfaction. Since the installation has been carried out however, upward extraction has at times been substituted; but he could state that the plenum system has not given nearly the same satisfaction with upward extraction as it did with downward extraction into a common duct in the basement. He was pleased to find that so many of the speakers favour the downward or double duct system, of which the Green Lane school, Bradford, was such a notable example. He was sure that the majority of those who had investigated this matter would not return to upward ventilation when they had once tried and had experience of the downward system. One speaker had suggested glazed bricks for air ducts. He was quite in sympathy with this, and would like to see all such ducts lined with glazed brickwork; but often this had to be discarded on the score of economy, and common bricks with smooth faces and the joints struck flush as the building work proceeds were used instead. He agreed with Mr. Garbutt in his objection to projections or excrescences in walls or ceilings; these were always a disadvantage and obstruct the *even flow of air*, such as is always desired and expected, besides forming a harbour for all kinds of dust and other refuse. With regard to the question of the positions of inlets and outlets raised by one of the speakers, these, we find, were the best when they were both on the same wall, the inlet being from 8 to 9 feet from the floor level, and the outlet quite close to the floor. This arrangement not only enables a better distribution of air, but it is more economical in its working, as there was a greater amount of heat extracted from the air before it is finally discharged into the vitiated air ducts than would be the case if the air were taken out at the ceiling level. One gentleman had mentioned schools of two or three stories arranged with upward extraction, which, in his opinion, was a mistake, and he could hardly see how it could be looked upon as otherwise, as the fact of the air being extracted at different heights means that the bottom rooms must have long shafts and the top rooms short shafts, which can only mean a very uneven extraction. To obtain sufficient area in the wall spaces for flues in schools is often difficult, as it is the custom of architects to design buildings with as much window surface as possible, which, in his opinion, is absolutely necessary; but on this account it was difficult to secure sufficient area in the air flues, which he considered advisable. He took this opportunity of thanking Dr. Kerr for the kind assistance he had given him and also for the loan of the chart, which that gentleman prepared whilst residing in Bradford. He also thanked the ladies and gentlemen for the kindly way in which they received his paper.

DISCUSSION ON

PRACTICAL CONSIDERATIONS IN CONNECTION WITH MODERN METHODS OF TREATING SEWAGE.

Opened by
Prof. A. BOSTOCK HILL, M.Sc., M.D., D.P.H.
(Fellow).

And J. E. WILLCOX, Assoc.M.Inst.C.E.
(Fellow.)

At Provincial Sessional Meeting at Birmingham, September 26th, 1903.

Prof. Bostock Hill:—

THE subject which has been chosen for this, the second sessional meeting of The Sanitary Institute held in the provinces, shows how important the question of sewage disposal is considered to be at the present time, and although we now know so much of the scientific principles underlying the purification of sewage, when we consider the condition of many of our rivers, both in town and country, it is not surprising that the matter should still retain a peculiar interest. The discussion which I hope will arise to-day on the subject is not concerned with the sewage question generally, but with certain practical considerations in connection with modern methods of the treatment of sewage. The old order has changed, and, although it is little more than ten years since the science of bacteriology became paramount among those concerned in the treatment of sewage, practically it may be said that modern methods of sewage treatment have eliminated all the older ones, such as precipitation, with the countless numbers of precipitants urged as desirable at one time or another, and that practically at the present time by modern methods we mean nothing but either treatment on land or by bacterial means.

In considering the subject we must not forget that the great natural

principles underlying the treatment of sewage on land and by artifically made bacteria beds are the same, and that modern systems of sewage treatment have arisen from a proper understanding of Nature's methods in removing waste matters from the soil.

Dealing first of all with the treatment of sewage on land, but few new points of interest have perhaps arisen of late, but I think that in the last few years we have gained certain fresh experience. For instance, we know that land treatment is absolutely useless unless the proper sort of land can be obtained, and not only must the land be proper in character, but also sufficient in quantity. To my mind, one of the greatest advances in dealing with sewage on land which has been made of late years has been the one whereby in many instances (notably on the Tame and Rea Farm, which you will have the advantage of seeing this afternoon) the old idea of preliminary chemical precipitation has been abandoned, and although the sewage sent from Birmingham and some of the other constituent districts is one containing large quantities of acid and chemical waste, at the present time Mr. Watson (the Engineer to the Board) has shown that it is possible to produce an excellent effluent without any of the expenditure and other troubles entailed by the addition of large quantities of lime or other precipitant, which has to be dealt with in addition to the solid matters of the sewage.

This method of treatment, of course, implies two processes preliminary to dealing with the sewage on land, viz., deposition of the detritus and coarser particles, and the provision of tanks for partially liquefying or peptonising the organic solids. This may, I think, be considered a great advance, for not only is there a saving of lime formerly used as a precipitant, but there is a diminished quantity of sludge to be dealt with, and the only extra expense necessitated is the provision of septic or resolving tanks. In many land treatment systems the sludge is treated on the same land. This is a mistake, for as it contains little manurial matter, and in the case of large towns a good deal of chemical matter, it is far better to get it taken away as far as possible and distributed on other lands.

There is no doubt that land, if it can be obtained of proper quality and in sufficient quantity, gives a perfectly good method of dealing with sewage, and excellent results are obtained, as in the case of Coventry at the new Baginton works (vide results), but, on the other hand, in practice great difficulties are met with, and bad results are often obtained, as the various actions in courts of law have shown. One great trouble is storm water, and personally I am of opinion that in many cases where land treatment is used, economy would result from treating the dry-weather flow by bacterial

methods and utilising the land for storm water; the great advantage of this is that the land can be practically returned to agricultural uses. This, however, must be looked upon at the present somewhat in the light of an experiment, especially in the case of towns like Birmingham, where large quantities of acid and chemicals are found in the sewage. As a result of former experience it was believed that the passage of un-neutralised sewage of this type was detrimental to the growth of vegetation, and it was considered necessary, therefore, to add a sufficient precipitant to remove all chemicals and neutralise the acid.

By the septic treatment to which the sewage is now subjected no doubt a considerable amount of iron is removed, and probably the whole of the acid, but whether or not in the long run the treatment will be successful experience only can show.

Coming to a consideration of bacterial methods, it is no exaggeration to say that one thing is now definitely proved, viz., that, properly carried out, and with a due regard to scientific knowledge, these are perfectly valid methods of dealing with sewage in small or large quantities. It will be out of place to take up your time with any elementary reasons for this, and the only points for consideration are the practical ones as to how such methods can be best utilised.

There are several plans of treating sewage bacterially, and unhappily each of us is apt to think that the one we have had experience of, if it has done its work satisfactorily, is the best under all circumstances. But this is not so, and the experience of the last few years has conclusively shown us that systems which will properly and satisfactorily treat the sewage of one district are quite unfitted for the treatment of another class of sewage under other conditions. There are still a few people so enamoured of land-treatment that they profess to ridicule so-called bacterial methods. The septic tank they hold up to ridicule as being nothing but the old cesspit under a modern name. This is perfectly true, and the difference is that in the septic tank and other systems we now utilise and control bacterial action which, in the case of the cesspit or dumbwell, was not understood.

At the present time, I think in practice there may be said to be three methods of working bacterial systems. The first is what is known as the septic tank followed by filtration through contact beds. The second is the use of coarse and fine, or so-called anaërobic and aërobic filters, both contact, while attention has particularly been given of late to the system by means of which we first of all remove suspended matter by chemical precipitation, and then filter through fine aërobic beds, or, as it has been termed, intermittent continuous filtration. Each of these systems has

its advocates. All of them under special conditions are capable of doing excellent work, of purifying sewage to such an extent that the resultant effluents may be discharged as practically non-polluting and non-putrefactive into ordinary streams.

In considering which of them is best adapted for any circumstances, or set of circumstances, we have to bear in mind many important points, notably the quality of the sewage, the surroundings of the works or the proposed works, the available fall in the land, and the stream into which the effluent is finally to pass, and it is only by a consideration of all these points that we can hope to obtain results reasonably satisfactory in all cases.

In many respects, no doubt, the septic tank, or to use a name which I gave it several years ago, and which I think is a better one, the resolving tank, is the simplest to work, particularly if it be adapted to contact beds with automatic supply, and although in many cases simplicity, and therefore smallness of cost, is an important point to bear in mind, it is not the most important in considering this question. The advocates of the resolving tank urge that by it the sludge question is solved, but is this the case? Experiments show that only a proportion of the suspended matter or sludge is removed from the sewage, is in other words digested, and that the whole of the mineral matter and part of the organic matter still remain to be treated. Owing to the very nature of the tank, and the fact that the process carried on is a putrefactive one, the sludge left, particularly in the case of some sewages, is very offensive, and though there may be less to deal with, what there is gives a good deal of trouble and is liable to cause nuisance. A good case in point locally is that of the sewage at Nuneaton. Before the present works (one of the most excellent of its type) were put down, experiments were made as regards the treatment of sewage by resolving tanks, and it was found that owing to the fact that the sewage of the town contains large quantities of albuminous matter coming from the fellmongers' works, both the septic effluent and the sludge were so horribly offensive that the dealing with it was liable to cause considerable nuisance. For small places, however, such as institutions and villages, where the sewage is of a domestic character only, and weak, then, no doubt, the resolving tank is a useful preliminary means of dealing with sewage bacterially.

As regards coarse and fine filters, the main points experience has brought to light are the absolute importance of putting the sewage on to coarse beds as free from inorganic suspended matter as possible. Therefore it is customary now, not only to screen, but to receive the sewage into a detritus tank previous to going on to the bacteria bed. Other points of

importance are that the beds should be of sufficient size, particularly as the capacity of the coarse beds will, owing to various reasons, soon become reduced, probably by some 30 per cent.

In connection with bacterial beds, too, both the nature of the material used and the size of the particles are of great importance. As regards the material, whatever is used should be hard, and in my opinion as smooth as possible. Any material which breaks down is unsuitable. Clinker, if used, must be hard, but of all materials of which up to now I have had experience I prefer granite to any other. Contrary to what one would expect at first, we know now that if the particles of which the coarse bed is made are too large the filter soon becomes blocked, and probably no question at the present time is of more interest to engineers engaged in the work of sewage purification than the one as to what is the best size for these particles.

Another important point is this: that, remove as much detritus as we can, if the coarse bed is used, it must be borne in mind that a time will come when the filtering material will require removing and cleansing, and although in some instances where domestic sewage only is treated the life of the filter may be long, there is every reason to believe that this time will eventually arrive. It is important, too, in my opinion, that the materials used should be washed; otherwise, even in material which looks comparatively clean, a large amount of fine matter will be found which tends to block up the filter beds, and also to wash out into the fine aërobic filter subsequently used. As regards the aërobic or oxidising filter, where the sewage receives its final treatment, and where the aim is to oxidise the innocuous nitrogenous matter left in it, we may have filters of two kinds. The contact bed, where as in the case of the anaërobic bed the liquid is held up in the contact with the particles for a limited period, or what I have previously referred to, the so-called continuous or streaming filter. From a scientific point of view there is no doubt that the continuous, or perhaps it had better be called the intermittent continuous or streaming filter, is the best. Time will not allow me to go into the reasons for this, suffice it to say that I believe that the result of experience up to the present time shows that this is a type of filter which has come to stay. It is only fair, however, to say that there are some difficulties attending its use. It requires more care and observation than the contact bed. It requires to be deeper, and in many places the configuration of the land makes it difficult to obtain the necessary depth; but when it can be obtained, and when it is of sufficient size, then I have not the least doubt that both from a theoretical consideration and on

account of the practical results it is undoubtedly the best. As regards the filtering material, though good results can be obtained with almost any hard material, still I believe that coal (which I was one of the first to introduce to public notice) is still the best. It produces *at once* an effluent far better than any other material, and from the experience that I have had of the Lichfield works now for many years, it continually produces an effluent of high-class quality. Granite chippings are also excellent, and the points which I believe to be of the most importance are that the particles should be hard, angular, fairly smooth, and not liable to break down. Coke breeze, which has perhaps been more used than any other, I do not consider to be particularly good, but it has been shown that excellent results have been obtained from broken stone and also from broken saggers in the potteries, where, of course, they are obtainable practically for nothing.

As regards the size of the particles I believe that, speaking generally, a size of about half an inch, with a few inches of fine material on the top of the filter, gives the most satisfactory results. Another point which has to be borne in mind in the consideration of streaming filters is the distribution. Many of the results hitherto recorded as obtained in this way have been unsatisfactory because of improper distribution, and the loss, therefore, of a considerable area of the filter. This difficulty, at the present time, looks like being overcome by the introduction of the distributor. One of the earliest distributors put down was the one on the coal beds at Lichfield by Mr. Garfield. This is very simple and has exceeded my expectations, because for many years, in winter and summer, it has acted satisfactorily, while the expense has been but small. A somewhat similar arrangement has been put into force at Salford, but travelling distributors of many kinds are now on the market, and where it is possible to use them better results still ought to be obtained.

As to the relative value of different bacterial systems, it is impossible, as I have said, to lay down a definite principle that under all considerations one is better than the others; but providing a very high-class effluent is to be produced, I am convinced in my own mind that the best means known to us at the present time is chemical precipitation first, and subsequent aërobic filtration through fine beds, preferably coal.

In closing these remarks, I feel that I should like to say a word or two on the characters of effluents. Engineers are continually asking for standards of purity to be laid down. It is very difficult to adopt a standard, unless it be a very high one. I consider one of the roughest, but at the same

time best, standards to be applied ordinarily is that of the maintenance of fish life in the pure effluent. It is an object lesson to be appreciated by all, and it shows that good oxidation is being maintained. As regards standards in the form of chemical results, I do not think any hard and fast ones can be laid down. I have seen bad effluents where the chemical results of impurity have been low, while *vice versâ* I have seen good effluents where, judging by the ordinary standards of albuminoid ammonia and oxygen absorbed, the effluents would have been condemned. Speaking generally, I think one may say, however, that any effluent sent into a stream should be of such a character that it contains sufficient oxidised nitrogen to prevent it becoming putrescent, and that the general character of the stream, supposing it to be an unpolluted one, will remain unaltered.

In the second Report of the Royal Commission on Sewage Disposal, now sitting, experiments are given dealing with the question of bacterial standards of effluents, and it would almost appear, from some of the views stated that an attempt may be made to require some standard of purification from the bacterial point of view. It has been shown that a chemically purified effluent may contain almost as many micro-organisms as a crude sewage, and it is urged by some of the ultra-bacteriologists that the purification effected, therefore, has been of little value, and that the danger of such a bacterial effluent is almost as great as that of the sewage. If this view be enunciated I do not think that practical experience will bear it out; and I am also convinced that even if it be true, instead of asking local authorities to add to their labour and expense the means for rendering sterile the otherwise purified effluents they send into streams, the proper thing to do will be, as my friend Dr. Reid has previously pointed out, either to go to streams other than those receiving such effluents for water supplies, or else to destroy the disease-producing organisms before they gain access to the sewage. With our present knowledge I look upon any system of sterilizing sewage effluents as impossible, because it must be borne in mind that not only would the ordinary dry-weather flow of sewage be so treated, but that in times of storm it would be equally necessary to sterilize every gallon of storm water, a large proportion of which, under present circumstances, would not and could not go to the sewage works proper at all.

Results of Analysis of Effluents and River Water.

Results expressed in Parts per 100,000.

Description.	Total solid impurity.	Free Ammonia.	Organic Ammonia.	Nitrogen as Nitrates and Nitrites.	Oxygen absorbed in four hours.	Chlorine.
Coventry, North Effluent	82	0·528	0·032	1·43	0·432	9·0
„ South „	84	0·412	0·040	1·32	0·532	9·9
River Avon above Effluents	60	0·016	0·018	Trace	0·232	2·6
„ „ below „	60	0·060	0·020	Trace	0·248	2·9
Lichfield, No. 5 Filter	82	0·515	0·040	1·54	0·334	9·4
Secondary Beds, Nuneaton	130	0·901	0·216	1·21	0·97	26·7

J. Edward Willcox

Dealt first with general principles underlying modern methods of sewage disposal. These general principles being established and understood, it will be conceded that good results must largely depend on overcoming practical difficulties which arise in connection with design and construction of works. Pointed out the impossibility of dealing successfully and economically with all classes of sewage by similar methods regardless of conditions obtaining in each case. First consideration must be volume and character of sewage to be treated and standard of purity required. Explained difficulties in way of fixing standard of purity, though a standard is very desirable from engineering point of view. Requirements of Local Government Board with respect to dealing with six times the dry-weather flow, results of gaugings in various districts extending over long periods showing that this requirement is excessive. Dealt with reason for divergence of volume and also rates of flow, and the effect that area and configuration of districts sewered had on this point and on pollution of streams by storm overflows; also as to how volume and character of sewage is affected by combined or separate systems and trade wastes and the rates of flow, for which provision must be made both for gravitation schemes and pumping schemes, and the effect of varying rates of flow on the design of the tank and filters, giving reasons for conclusions arrived at. Treatment in tanks a necessary preliminary to all methods of treatment. Hints as to the construction of detritus tanks and screening chambers, why over-screening of domestic sewage is undesirable, and means for

removal of silt from chambers. The design of settling tanks and septic tanks, methods of preserving scum if required, and drawing off sludge from septic tanks; over-septicized sewage and excessive accumulations of scum. Illustrations of difficulties met with by reason of excessive scum in septic tank, and offensive nature of septic tank effluent, and the effect upon such effluents when flowing in closed pipes; arangements for drawing off sludge from septic tanks. General remarks as to land treatment and as to the impracticability of taking a basis of so many persons per acre in considering land-schemes; suggested the basis should be gallons per acre, depending on character of land and nature of sewage. Remarks as to whether the area should be proportionate to the volume dealt with or to the organic impurity in sewage. Dealt with bacteria treatment and pointed out that as the final treatment consists, as is admitted, in aeration and nitrification, this must depend largely upon the intimacy of contact between the sewage and air. Gave reasons why in his opinion percolating filters were to be preferred in many cases to contact beds, and when the latter should be used; the effect of size of particles on contact bed effluents, means of distribution on contact beds, and the advantages and disadvantages of this system. The question of sludging of contact beds, and the materials of which particles should be made; with illustrations of difficulties from using unsuitable materials. The question of distribution on streaming filters, and the difficulties which occur in connection with obtaining even distribution; various types of distributors. Natural means by which contact or filter beds are aerated, and remarks as to varying factors of discharge; air supply, and depth of filters. Power-driven distributors; description of large experiments with electric and power-driven distributors on half-acre filters with various size particles now being carried out by the author at Hanley, in conjunction with Dr. G. Reid, and results obtained therefrom.

The Chairman (Dr. Alfred Hill) said that as the time at their disposal was all too little for the object they had in view in discussing this very important subject, his remarks would be very brief indeed. Naturally it came into one's mouth for the first utterance that the meeting was a most important one, and he thought they were indebted to The Sanitary Institute, not only for bringing them together, but for choosing a subject for discussion of such world-wide interest. It was important to their health, to their pockets, and particularly as regarded the command of land on which to treat sewage. To obtain such

land was by no means an easy matter. There might be land available which was unsuitable, or there might be no land available at all. In such case the bacterial system, which they were met there to discuss, came most timely to their assistance. He remembered thirty years ago the condition of their Birmingham sewage-farm. He was consulted in the earliest days of his office as Medical Officer when it was considered necessary to improve the conditions prevailing there. Those conditions were of the most horrible kind. Nothing was done but to run the crude sewage through tanks and then through a little land, where all that chose to subside did so, and the rest passed to the river, while the sludge and detritus had to be taken out, and were collected into a heap, which covered five or six acres of land a couple of yards deep. They might imagine what a nuisance that was. They would to-day see what had been done under the present arrangements; how much the condition of the farm had been improved. They would see much to admire in the manner in which the improvements had been carried out by Mr. Watson. From what he could hear, the Birmingham farm would well bear comparison with any similar installation throughout the country. What struck most people who did not work on the subject was the marvellous discovery that they could, by such simple means, deal with such a problem. There was, however, nothing new under the sun. Nature had been carrying on the process under their noses through all time, but man had not been observant enough to see it. They had not been clever enough to explain why a cesspool should go on being used for years and not get full. The bacterial method had furnished the explanation. They were now trying to imitate nature's own processes, and the farther they could make it natural so much the better.

Dr. Rideal (London) said the discussion had to deal with practical details, and as they were met in Birmingham and were going to visit the Birmingham works, which were referred to in the printed matter put before them, perhaps the details connected with Birmingham might have some bearing on the two papers presented by Dr. Hill and Mr. Willcox. One was the size of septic tanks. He thought they had a very good object lesson as to what should be the size of septic tanks from the Birmingham experiments. It would be remembered that Mr. Watson, at the last meeting of The Sanitary Institute at Bradford, gave them some figures as to the amount of suspended matter carried over by these septic tanks, and in the paper put in their hands they found the total dry weather volume of the Birmingham sewage was 25,000,000 gallons, and the size of the septic and detritus tanks together were about 12,000,000 gallons, in other words the tank capacity for intercepting the solids was only about half the dry weather flow. The effect of that was to give in the last two years about twenty-four grains of suspended matter in the average liquid which came out of the tanks. Now that quantity was very high indeed. Even in Birmingham, when

there was chemical precipitation, there were only about four or five grains of suspended matters. A good septic tank working should not give more than ten grains. The importance of that was in the matter of distribution, and it would have been exceedingly interesting if in the Birmingham experiments the septic effluent with these high suspended solids had been passed into contact beds, as well as into the continuous filters they were going to see. A septic effluent of this character passed on to contact beds would give them a much greater silting up than was found in other places. Another point was as to the sludging up of septic tanks which had taken place at Birmingham. The tanks now were periodically cleansed, and immediately after this operation the suspended matter in the effluent went down, so that in the last six months' working it had been reduced from twenty-four to fourteen grains. He mentioned those figures because, unfortunately, Mr. Watson, in referring to this matter, did not put it at all clearly at the Bradford meeting. It was clear that by emptying the septic tanks their capacity had been increased, and this had reduced the suspended matter they had to deal with. As to the distribution of the sewage on these continuous filters (a point had been made as to the expensive nature of some of the distributors) he wished to emphasize the fact, that in this connection it was the total cost of the plant, including distribution, which had to be considered. In that outlay the cost of the bed was certainly the largest portion. If they put down £5,000 as the cost of an acre six-foot bed, and £500 as the cost of distribution, they had an additional outlay of 10 per cent. for distribution. But supposing they used a cheap distributor costing only £100, or 2 per cent., it might very easily happen that the total flow through the bed might be 10 per cent. less than in the other case, and thus involve a greater absolute cost in having to provide a larger volume of filter. It was certainly worth while to pay much attention to the method of distribution, and put in a costly if an efficient distributor, if they could get an increase of even a few gallons per square yard per day in the flow through the bed.

Dr. Reid (Staffordshire County Council) said he was very glad to find that both Dr. Hill and Mr. Willcox thought filtration was better than contact. He thought it was a great mistake that they had ever heard of contact. Had they not heard of contact, by this time efficient means of distribution would have been devised, and efficient filters would have been at work throughout the country. He was afraid they must blame the engineering world for accepting without full examination Mr. Dibdin's suggestion, and for recommending authorities all over the country to lay down contact beds. He was sorry to see they were still laying down contact beds in many places, a policy which he thought they would regret. He quite agreed with Dr. Hill that it was impossible to adopt a method of distribution which would spray a large quantity of septic sewage in the open air in the neighbourhood of towns without causing a nuisance. Any method of

distribution therefore must be by a travelling distributor, so that they would have a small area displayed to the influence of wind instead of a large area carrying the smell a long distance. He also agreed with Dr. Hill that they could not lay down a standard of purity which would be satisfactory all round. They must take into consideration the circumstances of each case and the quality of the sewage to be dealt with. Mr. Willcox had referred to certain work in which the speaker had been associated with him at Hanley. The work of those filters at Hanley had been very instructive. They had as perfect distribution of the sewage over the filters as it was possible to obtain. They had two mechanical distributors, one designed by Mr. Scott Moncrieff, and one by Mr. Willcox, and in both cases they had distributed the sewage as evenly as possible. They had also four sizes of particles in the filters, the total area being half an acre, so that the experiments were on a large scale, and amply sufficient to show clearly the purification which could be effected by works, no matter of what size, with filters composed of different sizes of material. The four sizes of material used for the bodies of the filters in different sections were: three sixteenths of an inch rejected by one eighth of an inch; one quarter of an inch rejected by one eighth of an inch: half an inch rejected by a quarter of an inch; and two and a half inches rejected by one inch. As a matter of fact the results obtained by the fine grain filters were practically identical. The percentage of purification on the organic ammonia basis being 95 per cent., 93 per cent., and 93 per cent. in the case of particles of three sixteenths of an inch, one eighth of an inch, and a quarter of an inch. The corresponding figures of oxygen absorbed in four hours at 80° F. was 90 per cent., 90 per cent., and 91 per cent. The results from the larger sizes, although excellent, were not so good as in the case of the smaller sizes, the figures being 91 per cent. in the one case, and 86 per cent. in the other. The nitric nitrogen was 1·86, 1·61, and 1·75 per 100,000 in the case of the smaller sizes, and 1·59 in the larger sizes. They were the results of nine analyses in each case, and these included the results obtained in the first instances before the beds were properly ripe. If he had only taken the later results the nitric nitrogen figures would have been higher. In the case of the larger particles that was the only instance with which they had any trouble from obstruction. The experiments showed, he thought, that the proper and best size of material was a quarter of an inch and that there was no need to put a smaller size material in the filters. In Staffordshire they had been using a smaller size even than one eighth of an inch; but these experiments proved that they need not go down to such fine grain material. The depth of the filters was 4 ft. 9 in. to 5 ft.; he thought 5 ft. was the proper depth. It was needless for him to say that he fully endorsed Dr. Hill's remarks as to the work of the Royal Commission on Sewage Disposal, and the impossible suggestion that by any process sewage could be converted into drinking water.

Dr. Fosbroke (Worcestershire C.C.) said there were two points raised in the papers upon which he would like to express an opinion. That opinion was the result of 780 analyses made by the direction and at the cost of the Worcestershire County Council, who had laid down at Malvern and Oldbury a series of tanks, viz. (1) septic tanks with continuous filtration, (2) contact beds with streaming filters, and (3) upward flow tanks with streaming filters. There had been four different kinds of material used in connection with each set of tanks: coal, coke, bricks, and local stone. Shortly, the results of the experiments had been this: the septic tank with continuous filtration had given the best effluent, and the contact beds had not reached the high standard of purification which was once expected. Personally, he shared the opinion that the contact system was dead or, if not dead, was dying. He thought that coke was the best material that could be used. He could not agree with Dr. Hill that coal was the best. He also thought that for streaming filters the sizes of material described by Dr. Reid gave the best results. They also experimented with the effluents upon fish, using trout, and he was convinced that it was more a matter of aëration than anything else. Their experiments showed that extremely fine filtering media were not necessary, and that septic action with continuous filtration was better than contact.

Mr. Sidney R. Lowcock (Westminster and Birmingham), said that as his name had been associated with the filtration of sewage for a good many years, he had better refer first to the treatment of the tank effluent on filters. As long ago as 1890 he started experiments on the filtration of sewage, and he would like to read them the conclusions he then arrived at, and which he expressed in a paper on "The Filtration of Sewage," which he contributed to the Institution of Civil Engineers. "(1) That filtration is not only a mechanical but also a chemical and biological process when it is properly carried out, and when sufficient aeration is provided for; (2) That no practicable chemical process yet devised will, alone, do more than remove the suspended matters in sewage, and a very small portion of the dissolved impurities; (3) That dissolved impurities can only be removed by the action of micro-organisms, *i.e.*, by nitrification, and this can only be effected subsequently to the decomposition of the organic matter and the formation of ammonia, and in the absence of undecomposed organic matter; (4) That organic matter cannot be destroyed or converted into plant food until it has been dissolved; (5) That as nitrification proceeds far more rapidly in a moistened and aerated porous soil than in a liquid, and as the nitrifying powers of soil are capable of cultivation, the process should be carried on by means of filtration, so that the organisms can be cultivated and supplied with food in the filter; (6) That the most important factor in the processes of decomposition and nitrification, and the subsequent preservation of the nitrates formed, is an ample supply of air; (7) That the suspended matters in sewage

should not be allowed to pass on to the land or filter-bed as they clog the surface, and have to remain until they are decomposed before they can be destroyed. It is therefore evident that whether the organic matter in sewage be first deposited in the form of sludge and subsequently applied to the land, or be dissolved and passed on to the land as effluent from the tanks, the same process has ultimately to be carried out; and it must be a question of convenience and cost as to whether it is better to precipitate the organic matter in suspension and transport it to some place where it can be made use of or thrown away, or to endeavour to dissolve the whole of the organic matter in suspension and treat it in the effluent water so as to produce nitrates." Those were the conclusions he arrived at in 1890, and they were as true now as they were then. He was extremely glad to find that both the gentlemen who started the discussion, and those who had taken part in it, were all coming round to his way of thinking, that filters were a great deal better than contact beds. At that time he thought that it would be possible to work the filters continuously, but he had long since come to the conclusion that he was wrong. They could not work them continuously; they must work them intermittently, and he was very strongly of the opinion that the final treatment of the effluent should be, by means of intermittent bacterial filters on to the surface of which the liquid is sprinkled, as nearly as possible in the form of rain. He thought a good deal of confusion had arisen in the nomenclature of the three systems of bacteria beds used for sewage or tank effluent treatment. He would suggest that beds similar to those in use at Sutton should be known as "contact beds," and the other two systems in which the sewage or effluent is distributed over the surface intermittently or continuously, and allowed to trickle downwards through the filter, the outlet from which is always open to the air, should be known as "intermittent bacterial filters" and "continuous bacterial filters" respectively. Dr. Fosbrooke had already alluded to the experiments carried on at Malvern. He would like to add one or two remarks, as he was called into consultation by the Worcestershire County Council, and had prepared the designs and specifications for these works. There was one point in connection with the experiments which he wished specially to emphasize, that was, that the sewage was taken from the main sewer to each of the systems through V-shaped notches, the apex of each being on a level with the invert of the sewer. The proportions of the notches were such that the flow of sewage to each system was proportionate at all times to the flow in the main sewer, so that the systems were worked under really practical conditions, both as to the quantity and quality of sewage dealt with, and not taking a small regular quantity only, as was so often the case in experiments. That was a very important point. As regarded the thickness of the filtering media and the size of the particles, they were practically the same as at Hanley. He entirely agreed with all Dr. Hill had said with only one exception, that was, when he referred to the use of automatic machinery on a sewage disposal works. He did not believe it was possible to have automatic

machinery that would work satisfactorily under all the varying conditions. They had both the quality and the quantity of the sewage continually varying. Take the means which were often adopted with the intention of making the distribution of storm water automatic as an instance: The Local Government Board required provision for treating three times the dry weather volume as if it was all sewage proper, then a further three volumes must receive a modified treatment, and all beyond that can be turned into the river. A very common arrangement was to put in a fixed weir at the side of the main sewer, so that all sewage coming down up to the rate of six times the mean flow would go on to the sewage works, while all above this rate of flow would pass over the weir direct to the stream. Then a second weir was constructed lower down, so that the sewage up to the rate of three times the mean flow went on to the sewage tanks, and the balance up to the rate of six times was diverted to the storm water area. If rain came at the time of minimum sewage flow (when the sewage was frequently only tap leakage and infiltration water) the whole of it went into the works and was treated as sewage, though the greater portion of of it would only be storm water; but if the rain came down at the time of maximum sewage flow, then a considerable portion of the whole flow went direct into the river, and the first flush at any rate was as bad as crude sewage. That was one difficulty; the other was that for long periods the storm water area got no sewage at all, and consequently was not in a state of bacterial cultivation, and was not in a condition to do its work when necessity arose. The point he wanted to make was that such weirs could only deal automatically with rates of flow and not with volumes. They could not, therefore, be automatic, but must be under the control of the man in charge. This was of course only another instance of the well-established fact that the whole secret of the success or failure of sewage disposal depended upon intelligent, constant, scientific supervision and control.

Mr. J. S. Pickering (Cheltenham) said he would like to refer to the question of the material for the beds. He quite agreed with what the previous speaker had said, that the material should be as hard as possible. He had had a fair experience with various kinds of material on a large scale, and he had come to the conclusion that it was a mistake to employ coke or any material which was likely to disintegrate. He was sure that where coke was adopted there would be a difficulty in the silting up of the beds. With regard to the question of flow, he was very glad to hear what Mr. Willcox had said. He had endeavoured to explain that the quantity of sewage to be treated was not six volumes the dry weather flow per day, but at the rate of six volumes. It would seem rather extravagant to lay down works for treating six times the dry weather flow, and he did not think that was the intention of the Local Government Board. The works should be laid down in order to treat storm water which comes down

occasionally at the rate of six volumes a day, and as Mr. Willcox had said, it was rarely that six times the dry weather flow came down the sewers for twenty-four hours together. Mr. Willcox had asked whether any of those present, and who were to speak in the discussion, had any experience of the Dortmund tank. He understood that these tanks were about to be constructed and used at the Birmingham works, and he believed they would be a great success. His experience was that the Dortmund tanks were very useful indeed; he had experienced no difficulty in taking out the deposit from the tanks, but he thought that in large works like Birmingham it might be found desirable to have a small engine and pump for pumping into the delivery-pipes of the tanks for the purpose of stirring up the mud and deposit on the bottom before extracting it from the tank. He found by so pumping into the Dortmund tank that it need not be cleansed of the deposited matter for three or four weeks. There was another advantage of pumping occasionally into the tank, that it stirred up the deposit and allowed a great deal of organic matter to go through, as he thought there was such a thing as extracting too much of the organic matter. He thought if engineers and others would give particulars of their failures as well as of their successes, they would render a service by showing what to avoid. In the bacterial scheme he devised he had open channels between the septic tanks and the filters, and he had to close them because of the nuisance, and he thought that would be found necessary in the case of all septic tank effluents. He knew that with all manufacturing sewage there was a great nuisance from the septic tank effluent, and there would always be a difficulty in avoiding the nuisance in distributing the sewage over the bed, whether by percolation or otherwise. He did not see how they were to remedy that at present. He would like to bear out what Mr. Lowcock had said as to how unnecessary it was to have automatic gear. The work of emptying the beds could be better performed by intelligent labour.

COLONEL JONES, V.C. (War Office Sewage Farm at Aldershot), said that with regard to what Mr. Pickering had just pointed out, he agreed that the whole success of these contact beds or streaming filters (which seemed to be the most popular term at the present moment) the whole success or failure depended upon the character of the liquid sent forward from the septic tank. If the liquid from the septic tank contained much suspended matter it would choke up the contact beds or filters, and every effort must therefore be made to keep back the suspended matter in the septic tank if they wished to have a life for the filter bed. Suspended matter might be of two kinds: organic and inorganic. In his opinion it was not right to retain from entry into septic tanks anything but inorganic matter, because no microbes had a taste for anything of the mineral kingdom. In many cases, however, it was usual to keep out everything that could be screened, whether mineral or organic matter.

Mr. Lowcock had omitted one point when he went back to his old teaching. In that early teaching he (Mr. Lowcock) proposed to aerate the filter by forced draught, which had never been properly worked out. He would like to know more about it, and hear of more experiments in the way of mechanical aeration of filters and its results. Mr. Lowcock appeared to have given up the idea himself. The great object, to his mind, was to get aeration. He did not believe in mechanical methods because he did not know anything of them ; but he knew that the success of sewage treatment was dependent very much upon the access of air naturally. He might say he had been at the subject of sewage treatment for the last thirty-five years, more or less, and he, like Mr. Lowcock, might congratulate them on coming in the end to his idea of land treatment. His original dominant idea in those early times was "the separate system." The fights he had in those days to demonstrate the necessity of keeping the rain water from the sewers must be recollected by many present at this meeting. It was impossible to deal with sewage effectually unless they knew what they were going to get to treat within reasonable limits of variation, and since about the year 1885 engineers had generally admitted that his contention was right.

Mr. A. J. Martin (Westminster) said he had listened with a great deal of pleasure to these two papers, but he must admit he was taken a little aback at the list of points which Mr. Willcox hoped would receive full discussion in the very short time at their disposal. There was one point raised by Dr. Hill upon which he would like to say a word, that was as to the supposed offensive character of the liquid and sludge from a septic tank. He would remind them of a remark made by Mr. Watson in his valuable paper on "The Purification of Sewage," recently published in the *Contract Journal*. Mr. Watson there stated that "at a great sewage works, nuisance invariably followed pumping, churning, brushing and cleaning operations of all kinds"; but that "where the works were in a quiescent state there was almost an entire absence of smell." Nuisance was thus largely a matter of the way in which works were handled. Then with regard to the sludge. One reason why septic sludge had been found so offensive was the practice of having small tanks and removing from them large quantities of material only partially digested and in an active state of putrescence. If they had their tanks large enough to bring about the full decomposition of which the organic matter was susceptible, they would get a residuum considerably less in volume and which could be dealt with without any nuisance. In reference to the sludging up of filters, he disagreed with Colonel Jones as to the impropriety of removing organic suspended matter from the tank effluent on its way to the filter. For the last eight years they had made a point of freeing the effluent as far as possible from suspended matter. This point had not as a rule received the attention which it deserved. He was therefore glad to hear of the arrangements described in Mr. Watson's paper for removing

humus from the tank effluent. The discussion had been largely devoted to the question of the best mode of distribution. He was saddened to hear Dr. Fosbroke say that the contact bed was dead, or if not actually dead, that it was dying. He recollected that four or five years ago it was said that the septic tank was dead or dying; it was not dead yet; as a matter of fact it was in a very healthy state of convalescence, and he predicted that four or five years hence the contact bed would be in an equally healthy state. They had heard that day of the difficulties attending a proper system of distribution to a trickling filter. The practical merit of Mr. Dibdin's invention of the contact bed was that they got a perfect distribution. Every cubic inch of space received a cubic inch of water, and in due course, when the filter was emptied, a cubic inch of air. Then with regard to the superior chemical results claimed to be obtained by the trickling method, many of which were quoted in Mr. Watson's paper, one reason why the results from the contact system were not as a rule as good as they should be was the prevalent system of working without due regard to the character of the sewage. It was formerly usual to allow two hours for filling, two hours for contact, two hours for discharging, and two hours for aeration. Two hours for aeration of the bed was far too little. If they allowed two hours in all for filling, contact, and discharging, and left the remaining six hours for aëration they would get results far superior to those which had hitherto been obtained. In the installation laid down from his firm's design at Leeds, consisting of two septic tanks and a single set of beds, a purification was effected of 91 per cent. in respect of oxygen absorbed and 86 per cent. in albuminoid ammonia. Such results as these were generally considered unattainable by septic tanks and single contact. Their attainment at Leeds was in great measure due to the cycle of working adopted and the precision secured by the use of automatic gear. He entirely agreed with Dr. Rideal that it was true economy to spend money on an efficient distributing apparatus. It was a mistake to lay down ten or twenty acres of beds and then stint the sum spent on the apparatus for working them. He must totally dissent from Mr. Pickering's remark that the chief use of automatic apparatus was to save two or three labourers' wages. That was not the reason they used it. The reason why automatic apparatus should be used was, that a reliable and efficient gear like that at Leeds or Exeter would give them results which could not be obtained by manual regulation. By the use of automatic machinery they got the work done with absolute certainty and with due regard to the flow at the time. It was for this reason, and because of the results achieved, that he was of opinion that automatic machinery should be used in connection with bacteria beds.

MR. SCOTT-MONCRIEFF (London) said, at the recent Congress at Brussels, foreign gentlemen of great scientific distinction gave their views, and said

"they fully admitted that the natural treatment of sewage—sewage farming—was capable of yielding the best results." He quoted from the *Contract Journal*, in the issue of 23rd Sept., page 697, and he presumed that Dr. Rideal agreed with them. This found expression in the conclusions submitted by Dr. Dunbar, and he understood it was included in a resolution which was unanimously accepted. Now, if it got about in England that the best expert opinion, both here and on the Continent, considered land treatment the best way of dealing with sewage, the public might reasonably be astonished that they should be asked to spend enormous sums of money on less obvious methods.

Dr. Rideal (interposing) said he was at the meeting at Brussels, and there was no such resolution passed.

Mr. Scott-Moncrieff said he was indebted to the press for the information, and he was very sorry indeed that in this case he had been misled. But even if Dr. Rideal was correct, the Local Government Board did agree: so there was ground for his saying an opinion existed that land was the proper method of treatment. With this Colonel Jones cordially agreed. All he had to say was that theoretically that might be perfectly true, but nevertheless the majority of experts in this country now held the opinion that nine-tenths of the land in England was unsuitable for carrying it out. There were two main difficulties—the difficulty of getting land at all, and the still greater difficulty of obtaining suitable land. The question then came to be that if suitable land was not available, could they so concentrate the methods of nature that the solution of the problem could be carried out completely upon very limited areas. In the object-lesson they were going to see that afternoon, the extreme difficulty of treating sewage upon land was fully in evidence, and they would also find in Mr. Watson a responsible public servant who was confronted with this difficulty in an accentuated form. He was now devoting his attention to concentrating the methods of nature in the method now known as the bacterial treatment of sewage, and they might congratulate themselves on now having an opportunity of seeing this object-lesson on an extensive and important scale. It was impossible to exaggerate the value of this object-lesson. They would see land purchased at an enormous cost, and laid out at heavy expense, presenting difficulties which were admitted to be insuperable. They would be shown a fine arrangement of tanks in which anaerobic fermentation was going on. Further on they would see Mr. Watson's effort to solve the second part, the nitrifying half, of the problem. It was hardly necessary at this time of day to seriously consider the question of contact beds. The process was in no sense of the term scientific, The organisms must be looked at from the point of view of their life processes, and how to maintain them in a state of maximum efficiency. They had much in common with other forms of life, and he made up his mind long ago that they

had to be fed with known and regulated quantities of food and at regular intervals. It must be recognised that they were no more capable of absorbing excessive quantities of food than creatures in higher stages of development. Contact beds never have been and never can be arranged so as to provide optimum conditions for the final mineralisation of organic nitrogen. The necessary factors are the best rate of discharge, the best period between each discharge, the best supply of air, and the necessary depth of filter. He had designed a testing apparatus that could be seen at work that afternoon which enabled these four factors to be determined accurately for any given sewage, and also a distributing machine capable of delivering 500,000 gallons per twenty-four hours which could be adjusted so as to give effect to the results obtained from the testing apparatus, both as regards rate of flow and the periods of rest required between each discharge. He was far from wishing anyone to suppose that what he had done was final or incapable of improvement, but he was quite convinced that the line he had taken was the only one that could insure the final solution of the sewage problem in which purification in its best sense was combined with the preservation of the mineralised organic matter in an effluent which is a perfect plant food.

MR. F. B. O'SHAUGHNESSY (Birmingham) said, that from a somewhat varied experience, he was most strongly in favour of septic treatment as a preliminary operation in sewage works. One point in Dr. Hill's paper he would like to refer to, and that was the question of coal as a medium for bacteria beds. Some of the very first experiments he conducted on coming to Birmingham were with respect to the behaviour of this sewage in contact beds. Several of these beds were filled with coal, and the effluent from the coal was so good that on the first occasion of filling the effluent came out clear, sparkling and without odour, so much so that the men who worked the beds drank a quantity of this effluent. The difference between the effluent from the coal and that from the other beds was enormously in favour of the coal. With regard to land treatment, people used this term as if it implied one set of conditions only. As a matter of fact, effluents from different kinds of soil vary greatly, depending on the nature of the soil or subsoils. Even in Birmingham, where their land was of an exceptionally good quality, speaking in general terms, they had certain fields which would never give a satisfactory effluent. The cause appeared to be the presence of excessive proportions of ferrous iron in the subsoil of those fields. Each field ought really to receive special treatment, and required as careful supervision as an ordinary bacteria bed, if a thoroughly satisfactory effluent was desired.

DR. BARWISE (Derbyshire County Council) did not think a too vigorous protest had been made against any recommendation of the Royal Commission that sewage effluents should be bacteriologically treated, because it was generally

understood that the Royal Commission had some idea of setting up a bacterial standard of purification. It was not the duty of a sanitary authority to turn its sewage into a drinking water, but the duty of water authorities to take their supplies from unimpeachable sources. He would also like to add the weight of anything he could say in criticism of the large amount of suspended matter in the effluent from the septic tanks at Birmingham. He could not help thinking that they would be well advised in increasing the storage in their septic tanks, so as to further liquefaction before putting the septic tank effluent on the filters. They had been trying slag from iron works in his county, and he would like to warn any engineers who might be about to put down filters that this was a very dangerous material to use. It contained a large amount of carbonate of lime, which was soluble in the effluent from septic tanks. He had seen filters made of this material rapidly break down. Another point was in reference to distribution by revolving pipe distributors; the holes might be calculated mathematically to distribute the right amount of liquid per hole, but when a pipe was swirling round centrifugal action came into play, and no man could calculate the effect of centrifugal force upon a revolving pipe moving with varying velocities so that it would deliver the same quantity of sewage per square yard at different distances from the centre. Each pipe would have to be set by actually testing it, not by theoretical calculations. With Mr. Scott Moncrieff's revolving arm it could be done, and they would see it done at the Birmingham works. In conclusion, he would again like to protest against the idea of sewage effluents being so purified that sanitary authorities would have to turn such effluents into a bacterially innocuous fluid.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT BRADFORD CONGRESS.

Recommendations made in Section I.—

"The Members of this Congress are of the firm opinion that the national health would gain by the appointment of a Minister of Public Health, and the separation and enlargement of the Medical Department of the Local Government Board into a Health Ministry."

It did not appear to the Council desirable to take any action with regard to this resolution, on account of the political considerations involved.

"That this Section of the Congress is of opinion that the time has arrived for the systematic statutory notification of consumption, and recommends the Council of The Sanitary Institute to act upon this opinion."

The Council decided to approve and adopt this resolution, and to forward a copy to the Local Government Board.

Recommendation made in Section III.—

"That the Council of The Sanitary Institute do appoint a Committee to inquire into the desirability of establishing a standard bacteriological method for determining the efficiency of disinfectants, and take such steps as may be necessary for ensuring the legal control of disinfectants."

The Council have appointed a Special Committee to undertake this enquiry.

Recommendations made in the Conference of Municipal Representatives—

"That this Conference is of opinion that the high death-rate of infants calls for a special enquiry, and recommends that the Council of The Sanitary Institute should appoint a Special Committee to consider the subject."

As a great deal has already been done and the scope of the subject is very wide, the Council did not think that any advantage would arise from the appointment of a Special Committee.

> "That the amendments suggested in Dr. Eustace Hill's paper on 'Suggested Amendments of the Housing of the Working Classes Act, Part II.,' be referred to the Council of The Sanitary Institute for consideration and report, and that the Council of The Sanitary Institute be requested to ascertain the views of County Councils and Councils of County Boroughs throughout the country as to the emendation requisite in Part II. of the Housing of the Working Classes Act, and to take such action thereon as may seem to them desirable."

This resolution has been referred to the Parliamentary Committee to consider and report upon.

> "That it is desirable that the Registrar-General's quarterly and annual returns of births, deaths, and marriages should be published according to Sanitary Districts (*i.e.*, Urban and Rural Council Districts), instead of as at present according to Poor Law Districts; and that if necessary the registrars should be made officers of the sanitary authorities, who are those most interested in vital statistics."

The Council decided to approve and adopt this resolution, and to forward a copy to the Registrar-General and others interested.

Recommendations made in the Conference of Medical Officers of Health—

> "That whenever preservatives are added to food, their presence, nature, and maximum quantity should be indicated on a label or otherwise declared."

The Council decided to approve and adopt this resolution, and to forward a copy to the Board of Agriculture and to the Local Government Board.

> "That in view of the recurrent outbreaks of small-pox, largely contributed to by a certain class of society, the Government be requested to take into consideration the necessity for legislation to deal more effectually with those resorting to common lodging-houses and workhouse tramp wards as a constant and dangerous element in the propagation and dissemination of small-pox."

The Council decided to approve and adopt this resolution, and to forward a copy to the Local Government Board.

Recommendations made in the Conference of Sanitary Inspectors—

"That this Conference is of opinion that the time has arrived when, in the interest of Public Health, every person seeking to hold the office of Sanitary Inspector or Inspector of Nuisances shall, in addition to the technical qualification now recognised by the Local Government Board, be required to serve the office of assistant inspector for a minimum period of two years."

"That the Conference is further of opinion this can only be effected by the Local Government Board recognising such appointments and sanctioning the payment of one-half their salaries as in the case of Inspectors, and request the Council of The Sanitary Institute to bring the matter under the notice of the Board.

The Council consider that practical knowledge is very desirable, and that this point is to some extent met by the regulation which has been adopted with regard to requiring evidence of practical training from candidates before entering for the examinations of the Institute. But anything further than this appears to the Council impracticable at the present time.

"That this Conference of Sanitary Inspectors regrets that the Council of The Sanitary Institute has not so far seen fit to appoint one or more Sanitary Inspectors of experience from amongst the members of the Institute on its Examining Board, and further that they have failed to include one or more Inspectors as the Institute representatives on the Examining Board for Metropolitan Inspectors. In justice to the large number of Sanitary Inspectors who are associated with the Institute, we respectfully request the Council to take the necessary steps to remove this anomaly."

It did not appear to the Council that practical effect could be given to this resolution.

"This Conference of Sanitary Inspectors respectfully ask the Council of The Sanitary Institute to take into its early consideration the question of admitting (as members of the Institute) any Sanitary Inspector who has held office, as such, for a period of ten years, who shall have either passed the Institute's Examination for Sanitary Inspector or that of the Metropolitan Examining Board, at the reduced Annual Subscription of One Guinea."

The Council have this resolution still under consideration.

"That this Conference of Sanitary Inspectors, realising the difficulties that occur owing to the limited definition of the word 'drain,' ask the Council of the Institute to exercise its influence with the Government with a view to obtaining an extended definition of the term in question, as provided in Section 42 of the West Ham Corporation Act of 1898."

"That this Conference of Sanitary Inspectors is of opinion that the law relating to the sale of Food and Drugs requires amending, so as to enable an officer to procure samples of articles consigned to his district at any place of delivery beyond the limits of such district; and, further, empower such officer to institute all like proceedings as if such places were within the district for which he is appointed, and therefore ask the Council of The Sanitary Institute to petition the Government in favour of such an amendment."

These resolutions have been referred to the Parliamentary Committee to consider and report upon.

Recommendation made in the Conference on Hygiene of School Life—

"That this Conference of The Sanitary Institute on the Hygiene of School Life suggests the desirability of re-inserting the code regulations for payment of grant under Section 101*, in cases where absence is due to epidemic disease, as this has been a sanitary influence of great practical use in the past."

The Council decided to approve and adopt this resolution, and to forward a copy to the Education Board.

NOTES ON LEGISLATION AND LAW CASES.

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SEWERS.—"*Sewer*," *Meaning of—Local Government Board—Duty of Local Authority—Cleansing Sewers—Public Health Act, 1875 (38 & 39 Vict. c. 55), ss. 4, 19, 21.*

At the side of a road which was vested in a local authority was an open channel (not paved with stone and not very clearly defined on the side toward the centre of the road) made for the purpose of carring off the surface water from the road. In the channel were gullies by which the water passed through pipes into an underground drain. Rain water from the roofs and the curtilages of many of the houses in the road (including the plaintiff's) also passed through pipes into the channel. Sewage from one of the houses (not the plaintiff's) had escaped into the channel and had caused an illness of the plaintiff's child, and the plaintiff had thereby incurred expense.

In an action by the plaintiff against the local authority claiming an injunction and damages :—

Held, that the channel was a "sewer" within the definition contained in s. 4 of the Public Health Act, 1875, and that under s. 19 it was the duty of the defendants to cleanse the channel so that it should not be a nuisance or injurious to health.

An injunction was accordingly granted to restrain the defendants from permitting any foul or noxious matter to remain in the channel so as to cause a nuisance to the plaintiff, and £30 damages was awarded to him.

Decision of Phillimore J. affirmed.

Per Vaughan Williams L. J.: KINSON POTTERY CO. *v.* POOLE CORPORATION, [1899] 2 Q. B. 41, is not a decision that a drain may be a sewer for some of the purposes of the Public Health Act, and not for others.

WILKINSON *v.* LLANDAFF and DINAS POWIS RURAL DISTRICT COUNCIL, C. A. [1903] 695.

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